WIN A Yaesu FT-767GX! (see p. 81)

73 Amateur Radio

Issue # 313
Oct. 1986

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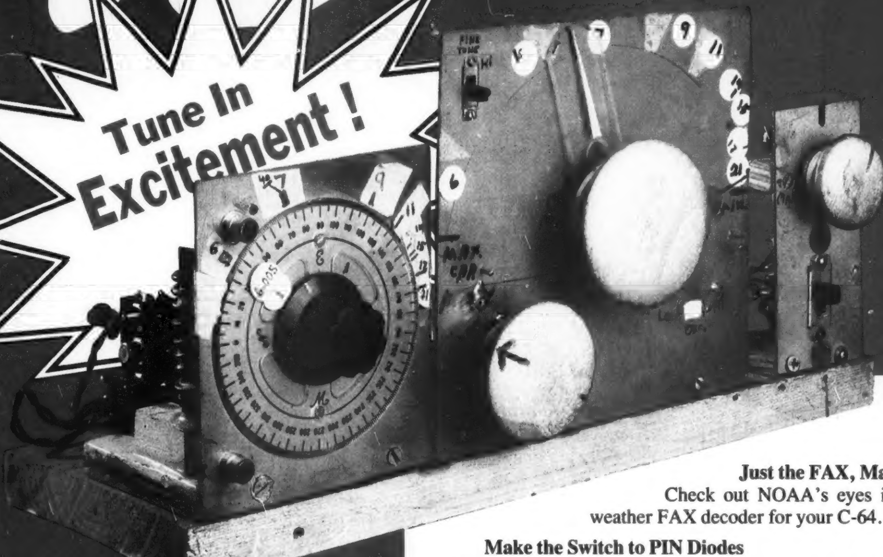
Tune In Excitement !



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- WEATHERSAT

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The new IC-12AT covers from 1260–1299.990MHz, has ten memory channels, memory scan, program scan and programmable offset. It also features an LCD readout, RIT and VXO, 32 built-in tones and a DTMF pad.

The IC-120 1.2GHz mobile transceiver has six memory channels, scanning, an HM-14 up/down scanning mic, RIT, LED readout and three tuning rates. Accessories include the ML12 10 watt amplifier and the PS45 slimline external power supply.

The IC-RP1210 completes your 1.2GHz system. It features a field programmable (198 channel, DIP switch), high stability PLL, repeater access to CTCSS, three-digit DTMF decoder for control of special functions, 10 watts, selectable hang time and ID'er.

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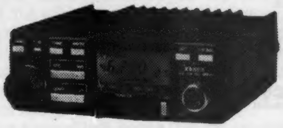

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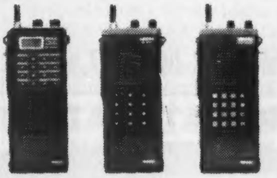

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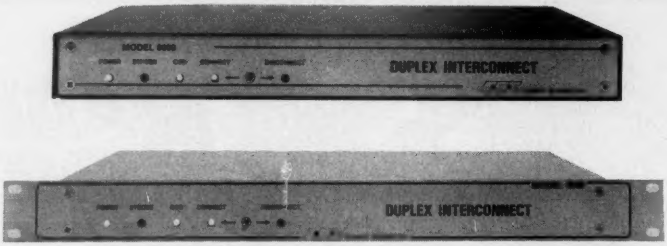
VISA

MODEL 8000 DUPLEX



- Desk top or rack mounted versions
- Pulse or fully regenerated tone dialing
- Full and half duplex operation
- Half duplex privacy mode
- Internally squelched audio
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- Connectors for options
- 10-16VDC powered

28 dip switches make all features user programmable and selectable.

OPTIONS

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8002	1000 call two tone signalling
8003	32 call CTCSS signalling
8004	FCC registered coupler
8005	Centralized computer billing system

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MODEL CS-9500

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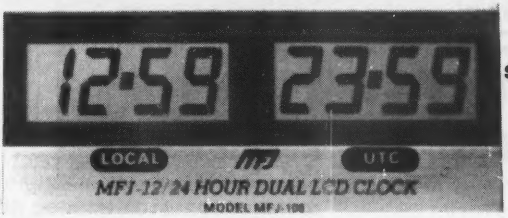
These MFJ 24 hour clocks make your DXing, contesting, logging and SKEDing easier, more precise.

Read both UTC and local time at a glance with the MFJ-108, $19.95, dual clock that displays 24 and 12 hour time simultaneously. Or choose the **MFJ-107, $9.95** single clock for 24 hour UTC time.

Both are mounted in a brushed aluminum frame, feature **huge easy-to-see 5/8 inch LCD numerals** and a sloped face that makes reading across-the-shack easy and pleasant.



MFJ-108
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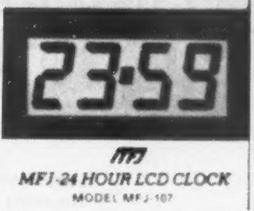
MFJ-107
$9.95



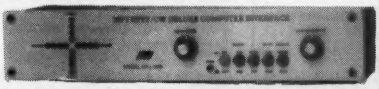
You can read hour, minute, second, month and day and operate them in an alternating time-date display mode. You can also **synchronize them to WWV** for split-second timing. Both are **quartz controlled** for excellent accuracy.

They are **battery operated** so you don't have to reset them after a power failure, and battery operation makes them suitable for mobile and portable use. Long life battery included.

MFJ-108 is 4½x1x2 in. MFJ-107 is 2¼x1x2 in.

RTTY/ASCII/AMTOR/CW COMPUTER INTERFACE

MFJ-1229 **$179.95**



Everything you need is included for sending and receiving RTTY/ASCII/CW on a Commodore 64 or VIC-20 and your ham rig. You get MFJ's most advanced computer interface, software on tape and all cables. Just plug in and operate.

The MFJ-1229 is a general purpose computer interface that will never be obsolete. An internal DIP switch, TTL and RS-232 ports lets you adapt the MFJ-1229 to nearly any home computer and even operate AMTOR with appropriate software.

A crosshair "scope" LED tuning array makes accurate tuning fast, easy and precise.

You can transmit both narrow (170 Hz) and wide (850 Hz) shift while the variable shift tuning lets you copy any shift (100-1000 Hz) and any speed (5-100 wpm, 0-300 baud ASCII).

Automatic threshold correction and sharp multipole active filters give good copy under severe QRM, weak signal and selective fading.

There's an FM (limiting) mode for easy trouble-free tuning that's best for general use and an AM (non-limiting) mode that gives superior performance under weak signals and heavy QRM.

A handy Normal/Reverse switch eliminates retuning while checking for inverted RTTY.

An extra sharp 800 Hz CW filter really separates the signals for excellent copy.

12½ x 12½ x 6 inches. Uses floating 18 VDC or 110 VAC with MFJ-1312, $9.95.

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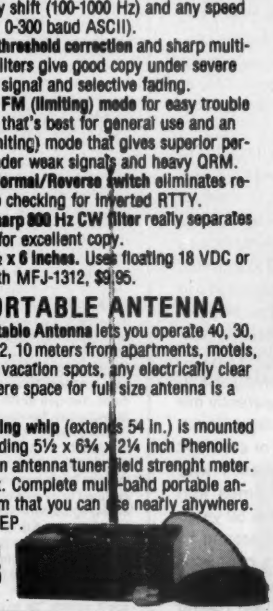

MFJ-1621
$79.95

MFJ ANTENNA BRIDGE

MFJ-204B **$79.95**

Now you can quickly optimize your antenna for peak performance with this portable, totally self-contained antenna bridge that you can take to your antenna site—no other equipment is needed.

You can determine if your antenna is too long or too short, measure its resonant frequency and antenna resistance to 500 ohms. It's the easiest and most convenient way to determine antenna performance available today to anyone. There's nothing else like it and only MFJ has it. Built-in resistance bridge, null meter and tunable oscillator-driver (1.8-30 MHz). Uses 9 V battery. 4 x 2 x 2 inches.

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The authoritative "World Radio TV Handbook" rates the MFJ-1024 as "a first-rate easy-to-operate active antenna ... Quiet, with excellent dynamic range and good gain ... Very low noise factor ... Broad frequency coverage ... the MFJ-1024 is an excellent choice in an active antenna".

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MFJ-1024
$129.95

200 WATT VERSA TUNER

MFJ-901B **$59.95**

MFJ's smallest 200 watt Versa Tuner matches coax, random wires and balanced lines from 1.8 thru 30 MHz. Works with all solid state and tube rigs. Very popular for use between transceiver and final amplifier. Efficient air-wound inductor gives more watts out. 4:1 balun, 5x2x6 in.

ROLLER INDUCTOR TUNER

MFJ-989 **$329.95**

Meet the "Versa Tuner V", the compact roller inductor tuner that lets you run up to 3 KW PEP and match everthing from 1.8 to 30 MHz.

Designed to match the new smaller rigs, the MFJ-989 is the best roller inductor tuner produced by MFJ. Our roller inductor tuner features a 3-digit turn counter plus a spinner knob for precise inductance control for maximum SWR reduction. Just take a look at all these other great features! **Built-in 300 watt, 50 ohm dummy load, built-in 4:1 balun and a built-in lighted meter** that reads SWR and forward and reflected power in 2 ranges (200 and 2000 watts). Accuracy ±10% full scale. Meter light requires 12 VDC. 6 position antenna switch. 10¾ x 4½ x 15 inches.

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THE EARTHQUAKE

We're assured that one hell of an earthquake is coming to California—and fairly soon. The quake is inevitable, only the date is in question.

Further, we're told by experts who have put the data into computers that we can expect tens of thousands killed and at least a hundred thousand or so injured. Golly, it's almost enough to make a person think—so, making an unusually mighty effort, I thought. You don't want to know what I thought, it would only depress you. Why not skip on to the next break in my stuff—to something which is even more frightening to think about. Oh, I'm going to get your well-deserved guilt stirred up to a fever pitch.

Now, when the Big One hits, you know as well as I that two main things are going to happen. First, buildings will be crashing all over the place, killing and injuring an incredible number of people. Second, power, water, and telephones will be completely wiped out. And you know what that means—the *only* practical communications will be by amateur radio.

Repeaters, unless they have emergency power, will be out. It won't be possible to fix 'em because most roads and highways will be damaged beyond immediate repair. What roads there are left will be jammed with cars trying desperately to escape the area.

Ham communications will be the backbone of the disaster relief—making it possible for the authorities to contact each other—to send out rescue teams via motorcycles or helicopters—to get medicines delivered.

Hams will have to cope with hysteria, questions of who really is in charge, food, water, and medicine distribution, fire storms, gas leaks, floods from broken dams, bodies to be buried, injured needing medical attention, gasoline distribution, rioting, gangs of thieves, etc. Then, once the more serious emergencies are taken care of, comes the welfare message blitz—millions of people unable to use the telephones or get out of the area wanting to locate loved ones, family, and friends. Messages within the devastated area—messages coming into and out of the area. We're talking millions upon millions of messages.

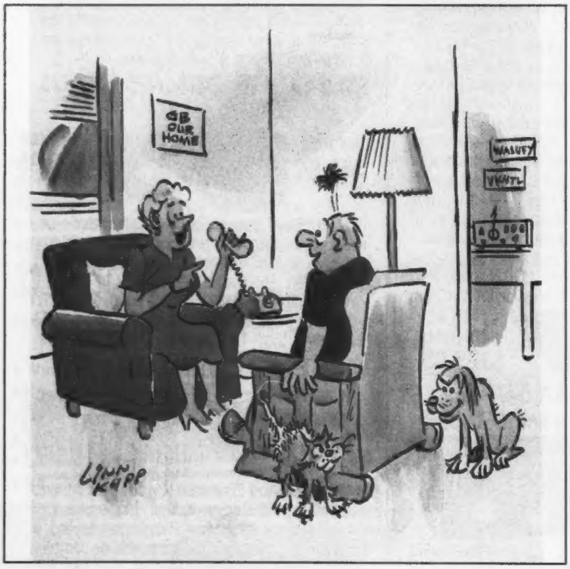
We're not talking a handful of hams on 80m with hand keys tapping out messages at 10 wpm all night for a few days—we're talking tens of millions of messages over a period of weeks to months. We're not talking about anything we even remotely have in prospect right now in a message-handling system.

We're also not talking about what few hams we apparently are going to have left—probably with an average age of 60 or so. What few of you old buzzards who haven't ruined your lungs and body beyond repair with 50 years of smoking or carrying around 50 pounds of fat hanging over your belt may have the stamina to last for a few days, but that isn't going to cut it.

What you're going to give any-

Continued on page 10

Caption This Cartoon—And Win!



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- **100 memory channels**
  Frequency and mode may be stored in 10 groups of 10 channels each. Split frequencies may be stored in 10 channels for repeater operation.
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  Subtone is memorized when TU-8 is installed.
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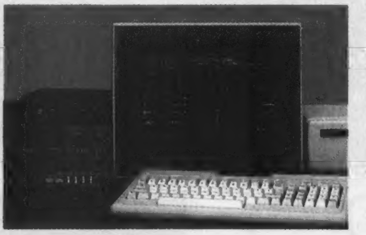
  IF shift, tuneable notch filter, noise blanker, all-mode squelch, RF attenuator, RIT/XIT, and optional filters fight QRM.
- **MC-43S UP/DOWN mic. included**
- **Computer interface port**
- **5 IF filter functions**
- **Dual SSB IF filtering**
  A built-in SSB filter is standard. When an optional SSB filter (YK-88S or YK-88SN) is installed, **dual** filtering is provided.
- **VOX, full or semi break-in CW**
- **AMTOR compatible**



POWER
ON
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VOICE
NB
ATT
HF TRANSCEIVER
KENWOOD TS-440S
MODE/KEY
ALC
PWR
SWR
LSB
USB
CW
AM
FM
FSK
SEND
AUTO
AT TUNE
REC
THRU
OFF
M►V
SCAN
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M.IN
ENT
14.200.0
MIC
CAR
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FUNCTION
RIT
A/B
XIT
SPLIT
T-F SET
A=B
RIT/XIT
IF SHIFT
AF
RF
1MHz
DOWN
BAND
UP
F.LOCK
PROC
NOTCH
AGC FAST
SELECTIVITY
AUTO
N
M1
M2
W
OFF
OFF
SLOW

Optional accessories:
• AT-440 internal auto. antenna tuner (80 m—10 m) • AT-250 external auto. tuner (160 m—10 m) • AT-130 compact mobile antenna tuner (160 m—10 m) • IF-232C/IC-10 level translator and modem IC kit • PS-50 heavy duty power supply • PS-430/PS-30 DC power supply • SP-430 external speaker • MB-430 mobile mounting bracket • YK-88C/88CN 500 Hz/270 Hz CW filters • YK-88S/88SN 2.4 kHz/1.8 kHz SSB filters • MC-60A/80/85 desk microphones • MC-55 (8P) mobile microphone • HS-5/6/7 headphones • SP-40/50B mobile speakers • MA-5/VP-1 HF 5 band mobile helical antenna and bumper mount • TL-922A 2 kw PEP linear amplifier • SM-220 station monitor • VS-1 voice synthesizer • SW-100A/200A/2000 SWR/power meters • TU-8 CTCSS tone unit • PG-2S extra DC cable.

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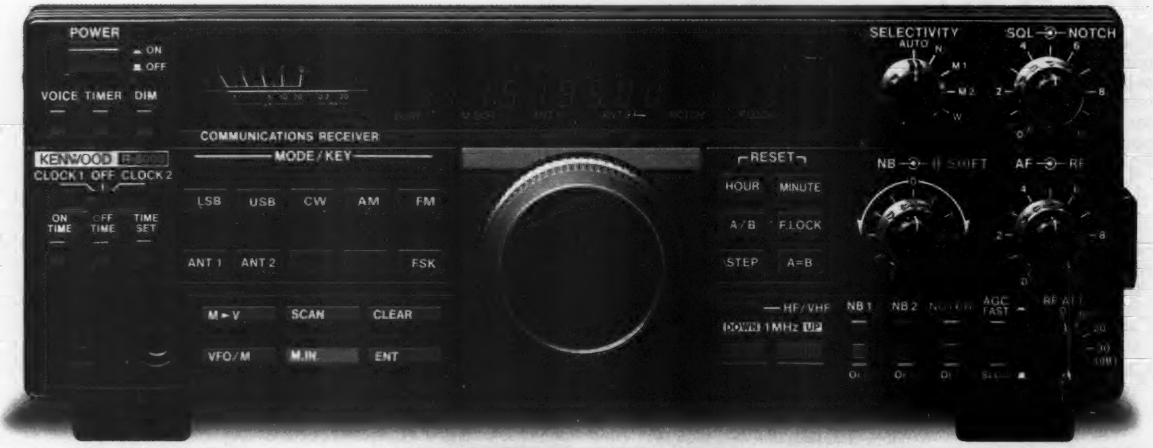
NEW

Listen Up!


POWER
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OFF
VOICE
TIMER
DIM
KENWOOD R-5000
CLOCK 1 OFF CLOCK 2
ON TIME
OFF TIME
TIME SET
COMMUNICATIONS RECEIVER
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LSB
USB
CW
AM
FM
ANT 1
ANT 2
FSK
M ► V
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CLEAR
VFO/M
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RESET
HOUR
MINUTE
A/B
F.LOCK
STEP
A=B
HF/VHF
DOWN 1MHz UP
SELECTIVITY
AUTO
SQL NOTCH
NB IF SHIFT
AF RF
NB 1
NB 2
NOTCH
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R-5000

High performance receiver

***THE* high performance receiver is here from the leader in communications technology—the Kenwood R-5000. This all-band, all mode receiver has superior interference reduction circuits, and has been designed with the highest performance standards in mind. Listen to foreign music, news, and commentary. Tune in local police, fire, aircraft, weather, and other public service channels with the VC-20 VHF converter. All this excitement and more is yours with a Kenwood receiver!**

- **Covers 100 kHz-30 MHz in 30 bands, with additional coverage from 108-174 MHz (with VC-20 converter installed).**
- **Superior dynamic range.** Exclusive Kenwood DynaMix™ system ensures an honest 102 dB dynamic range. (14 MHz, 500 Hz bandwidth, 50 kHz spacing.)

- **100 memory channels.** Store mode, frequency, antenna selection.
- **Choice of either high or low impedance antenna connections.**
- **Extremely stable, dual digital VFOs.** Accurate to ±10 ppm over a wide temperature range.
- **Kenwood's superb interference reduction.** Optional filters further enhance selectivity. Dual noise blankers built-in.
- **Direct keyboard frequency entry.**

- **Versatile programmable scanning, with center-stop tuning.**
- **Voice synthesizer option.**
- **Computer control option.**
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- **Power supply built-in.** Optional DCK-2 allows DC operation.
- **Selectable AGC, RF attenuator, record and headphone jacks, dual 24-hour clocks with timer, muting terminals, 120/220/240 VAC operation.**

Optional Accessories:

• VC-20 VHF converter for 108-174 MHz operation • YK-88A 1.6 kHz AM filter • YK-88S 2.4 kHz SSB filter • YK-88SN 1.8 kHz narrow SSB filter • YK-88C 500 Hz CW filter • YK-88CN 270 Hz narrow filter • DCK-2 DC power cable • HS-5, HS-6, HS-7 headphones • MB-430 mobile bracket • SP-430 external speaker • VS-1/VS-2 voice synthesizer • IF-232C/IC-10 computer interface.

More information on the R-5000 and R-2000 is available from Authorized Kenwood Dealers.

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Specifications and prices are subject to change without notice or obligation.

QRX . . .

EDITED BY PERRY DONHAM KW1O

Sweet Sweeps

THE BIG WINNER in *73*'s Powerhouse Sweepstakes is **Judi Booker N4NMH**. Judi has received her complete TM-2570A station and says she loves it! (See "Letters" in this issue for more from Judi.) Kenwood's Wayne Yoshida KH6WZ flew in from the West Coast to draw the lucky entry and visit with the *73* staff. If you didn't win this time, there's another opportunity for you this month: The brand new ***73* Megaband Sweepstakes** featuring Yaesu's FT-767GX is officially under way! (The entry blank is on page 81, but we encourage you to first read pages 1–80. We'd hate for you to miss anything important.)

Ten Returns

AMSAT-OSCAR 10 is feeling much better now thanks to the tireless efforts of AMSAT engineers. After two months of cautious diagnostics, the spacecraft's computer operating system was rewritten to avoid the areas of memory that were damaged by radiation. (High-energy particles traveling through the satellite can damage cells of memory; the number of damaged cells had grown too large for the computer's error-correcting system to handle.) **Karl Meiner DJ4ZC** produced the crucial memory map that showed which areas were faulty. The satellite is now in stable condition and running on a reduced operating schedule, with the hope that more user time will be available in the very near future.

Packet Lunacy

TOM CLARK W3IWI has had success in bouncing packets off the moon using an 85-foot dish located at Gilmore Creek near Fairbanks, Alaska. 140 Watts into the 38-dBi-gain antenna yielded about 700 kW of rf at 432 MHz. While no connections were established, Tom monitored several time-stamped packets which displayed the 2-second round-trip delay. During the outing, 19 stations were worked on CW/SSB. Activities were cut short a few days due to the intense boredom produced by the lack of active stations.

Racy Award

THE REDCLIFFE RADIO CLUB of Queensland, Australia, has come up with one of the most complicated awards I've ever seen. It appears to be some sort of road rally done by radio. . .what you do is work cities in order along a circuit that travels all around Australia. There's some sort of bonus allowed when you do this in a certain amount of time, and time penalties just to make things interesting. Here's an example of how the rules read: "To encourage inland contacts, should the return to the coast be at the location where the coast was left and the second contact is not with the same station or if the same coastal station is worked after 48 hours have elapsed, the inland contact is worth an extra 50 points." I should point out that the award sounds really sharp; if you'd like to take a shot at figuring it all out, send an SASE to *73* Magazine, WGE Center, Peterborough NH 03458, Attn: Rally. I'll send you your very own copy of the rules.

ACC Expands

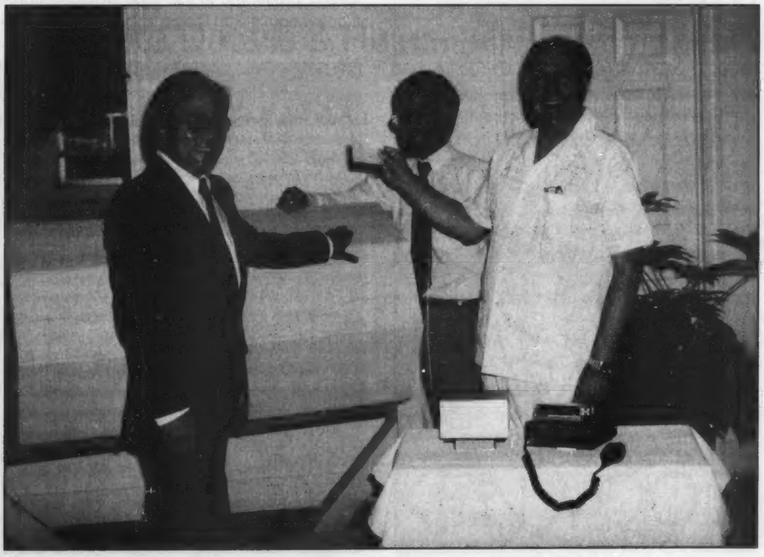
ADVANCED COMPUTER CONTROLS has moved to a new facility in Santa Clara, California. Their new address is ACC, Inc., 2356 Walsh Avenue, Santa Clara CA 95051; (408)-727-3330. A dedicated technical support line is also up at (408)-727-3414.

Go FAR

THE WINNERS of the 1986 Foundation for Amateur Radio scholarships have been announced. They are: James Baker KI4YN (John Gore Memorial, $900); Richard Westenberger N9DKR (Richard G. Chichester Memorial, $900); David Tancrell KB4GIA (Edwin S. Van Deusen Memorial, $350); Michael Kazigian KA2MRK, Leslie Ann Redman KA9PCV, Michael Silverglate KR9Q, David Swiatlowski KA2KLM, Diane Willemin KE8DJ, and Tony C. Wood KB4DNE (QCWA Memorial, $600 each); Douglas Swiatlowski KA2KMT (QCWA Robert Cresap Memorial, $500); Francis Horan KA3CJR (Radio Club of America, $500); Joy M. Davis KE8EG (Edmund B. Redington Memorial, $500); Carol Dunlap KA1NCX (Young Ladies' Radio League, $500); Michael Krensavage KA3CUP (Amateur Radio News Service, $750); Bernard Collins KA3FGV (Columbia Amateur Radio Association, $750); Christine Gray KA3NAR and Eric Smith KA3KJO (Baltimore Amateur Radio Association, $500 each); and David German N4FAD and Todd Wiggins KB4BDK (Dade Tropical Hamboree, $500 each).

Pool Rule

VOLUNTEER EXAMINER COORDINATORS have now been given the responsibility for maintaining the question pool used for ham license examinations. This latest action deregulating the volunteer-exam system was announced at a meeting between VECs and the FCC in mid-August. The Report and Order also specifies that volunteer examiners are the final judges to determine whether or not a question has been answered correctly. The volunteer examiner will also design each exam along guidelines set up by the VEC. The new rules are flexible enough to allow less traditional methods of giving a test, such as an interactive computer program which asks questions and immediately grades responses.



At the 73 Powerhouse Sweepstakes drawing (l to r): Wayne Yoshida KH6WZ, Perry Donham KW1O, and Wayne W2NSD/1.

Instant License

WE'RE A FEW STEPS CLOSER to an international amateur radio license, at least on this side of the world. The Inter-American Telecommunications Conference, a function of the Organization of American States, now has a draft of the **Inter-American Amateur Radio Convention**, a document that would set up a formal structure of reciprocal licensing between member nations of the OAS. The agreement will be presented to the Conference in November of 1987; meanwhile, OAS nations are being given the chance to make comments on the draft version. If the Conference gives the stamp of approval, it would be up to each individual government to ratify the treaty. A similar "universal license" is being worked on in Europe...will we someday see a single worldwide ham radio license?

Welcome!

THIS ISSUE of *73* sees the addition of three new columns and a new columnist. **Mike Bryce WB8VGE** is the new columnist; he takes on "QRP." **Ralph Taggart WB8DQT** of *The New Weather Satellite Handbook* fame will be keeping you up to date on...you guessed it, weather satellites in "WEATHERSAT." **Mike Stone WB0QCD**, Editor of *Spec-Com Journal*, will be writing about amateur television in "ATV." And "DX" returns to the pages of *73* with an author every DXer knows but who has asked not to be named until next month. Hmm...I wonder if that means he doesn't want to be paid until next month? Don't forget to rate these new kids on the block by filling out the Feedback card and mailing it in—along with your subscription order, of course!

Here's Russ Rennaker W9CRC at his 80th birthday party...are you 80 feet up, Russ?

Captain Caught

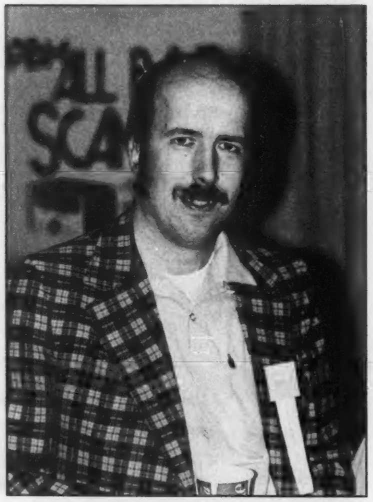
CAPTAIN MIDNIGHT, the enterprising fellow who took HBO off the air for 4-1/2 minutes last April, turned out to be **John MacDougall KA4WJA**. John protested HBO's decision to scramble their satellite signals by overriding the HBO signal and displaying his own message across the country. The Justice Department and the FCC tracked MacDougall down by the process of elimination: Only two of the few earth stations powerful enough to do the deed use character generators that match the one used in the protest. The maximum penalty for transmission of a false satellite signal is a $10,000 fine and one year in prison; after plea bargaining it appears that the sentence may be reduced to a $5,000 fine, one year on probation, and the surrender of John's ham license for one year.

18 Or Bust!

THE AMERICAN RADIO RELAY LEAGUE has filed a petition with the FCC seeking early access to the 18-MHz amateur band defined in the last World Administrative Radio Council. The ARRL feels that there is plenty of room for U.S. hams on the band, and pointed out that the government has shifted its stations off of 18 MHz, and that the few nongovernmental users have long since vacated. Fifty-seven countries currently permit amateur activity on the band.

Hambassador

THE WINNER of the first **Ham Ambassador Award** sponsored by Advanced Electronic Applications is **Mary Duffield WA6KFA**. The award, presented at the 1986 ARRL National Convention in San Diego, is based on dedication to amateur radio, influence on non-hams, and the initiation of special projects and programs to promote our hobby. Mary is a 70-year-old retired schoolteacher who keeps herself busy by taking ham radio to the masses, including designing and running a for-credit class in ham radio at the Del Mar Middle School—a program chosen by the California School Administration as one that should be copied throughout the state. Mary was presented with $1,000 as a way of saying, "thanks."



Ralph Taggart WB8DQT, our new WEATHERSAT columnist. Welcome aboard!

SCRAN Plan

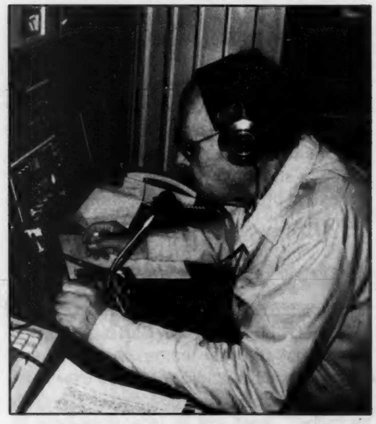
MEMBERS of the **South Coast Radio Amateur Network** (Torrance, Calif.) recently pulled out all the stops to provide communications for the California Special Olympics. Over the three-day event, 37 hams handled several thousand messages ranging from a request for paper cups to medical emergencies. A portable repeater was installed to provide reliable coverage over the UCLA campus. The Special Olympics are designed to give mentally handicapped folks "the opportunity to develop physical fitness, gain new friendships, express courage, and improve their self-image." SCRAN member Henry Schmidling WA6RJA reports that the amateur volunteers "received much more than they gave."

Section Election

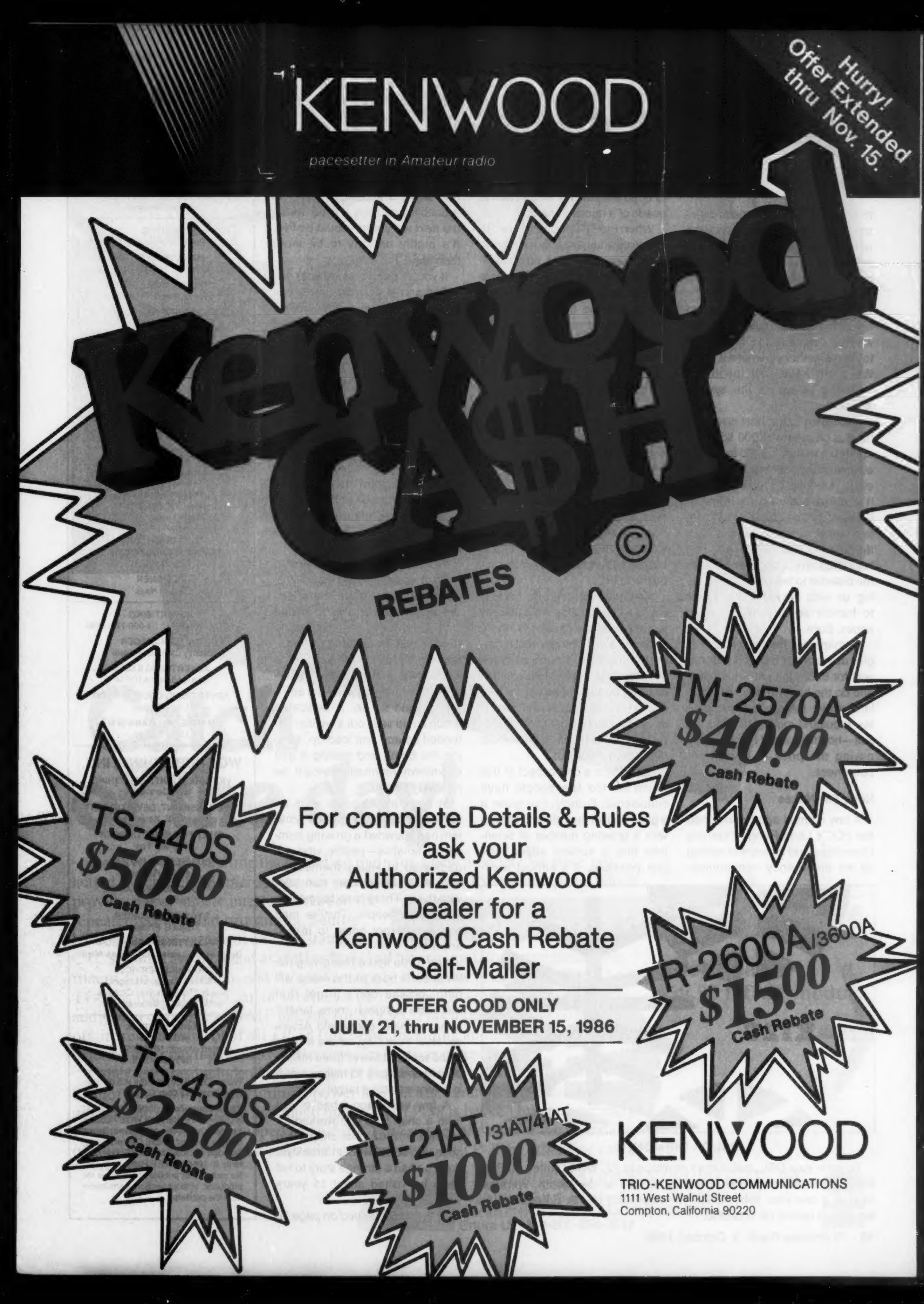
THE ARRL EXECUTIVE COMMITTEE has decided to create a new ARRL section: West Texas. The effective date is January 1, 1987.

Finis

OK, enough of this stuff. Thanks this month for help from *Westlink Report, Gateway, The ARRL Letter, Amateur Satellite Report,* and *The W5YI Report*. Send your news items and photos to *73* Magazine, WGE Center, Peterborough NH 03458, Attn: QRX. See you next month!



Wayne W2NSD/1 took some time off to head north and operate VE7EXPO.



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NEVER SAY DIE

from page 4

thing for will be high-speed automatic communications systems using emergency-powered repeaters which will take typed messages and relay them where directed with no human help. We have the technology to set up such a system right now. What we don't have is the manpower to put it together and make it work. We don't have half the hams we need to set up the system we need.

According to the best count we have a bit over 400,000 licensed amateurs in the U.S. Of those it's estimated that 50% at most could even remotely be called active. It's more realistic to think in terms of maybe 100,000 fairly active hams. About 15% are in California—15,000 hams. At least two-thirds won't be near enough the disaster to help directly—leaving us with maybe 5,000 hams to handle several million messages. Sure.

Perhaps our best bet is to just give up—admit it's beyond us and wait for El Biggo to hit—then sigh and do the best we can with what little we've set up and accept a few thousand more dead as a result—hoping it won't be our family paying the price of our unpreparedness.

Now, The Nukes

A few months ago I mentioned the FCC's Long Range Planning Committee and its hope of setting up an emergency communications system which would be able to cope with the communications needs of a nuclear attack.

When the FCC found the ARRL directors adamant about stopping their move toward a no-code license, the FCC Commissioners could see no way for amateur radio to develop the million or so young hams it would need before it could organize the needed automatic high-speed communications system. They recognized that the few hams we have left—with an average age of 56, and aging fast—were hopeless.

I'm sure the ARRL directors never gave any consideration to the urgency of the emergency our country faces. Instead, they emotionally reacted, reflecting their own personal feelings rather than intelligence. The Commissioners were absolutely disgusted at this shortsightedness. They disbanded the LRPC.

Since the thought of a nuclear war is so terrible that we generally just dismiss the possibility, there doesn't seem to be any real emergency involved. A nuclear attack is impossible—right? Heck, with a growing number of scientists predicting a nuclear winter which could devastate most of the world, we're sure that even Russia would never start nuking us.

Alas, there's one aspect of this which far too few people have considered. Frankly, I've given it a good deal of thought and I agree with a growing number of scientists that a nuclear attack isn't just possible, it's almost inevitable. No, make that inevitable. I don't see any way it can be avoided.

The nuclear attack I'm talking about will probably hit either New York or Washington—more probably New York City. And when is this expected? The probability is high it'll be within the next ten years—could be five. It's highly unlikely to be more than ten.

If you've been reading your scientific and news magazines, you know that they've got nuclear bombs down to where they can be backpacked into a country now. If smugglers can bring in hundreds of tons of drugs a year, I don't think they'll have a lot of trouble with a few pounds of nuke.

Where can they get a nuclear bomb? You've read about several students who have, just by researching declassified material, designed atom bombs which our nuclear scientists say would be quite effective. Anyone can make one if they have the materials.

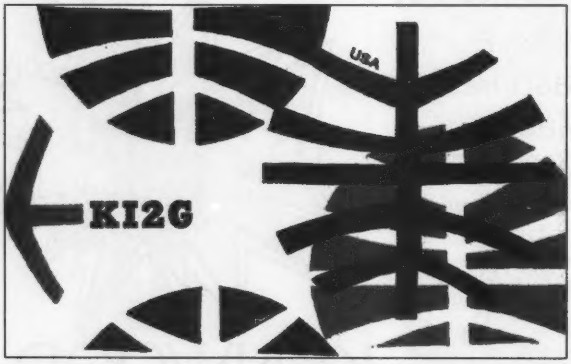
We know Kaddafi was trying to build a reactor so he could produce weapons-grade materials. We also know he's a bit miffed with us right now. Then there's the reactor they're building in Iraq—not one of our best friends in the world. And another in Pakistan—one in India—China—Israel—France and so on. A dedicated group could seek out a weaker defended source and load up. Making the bomb and getting it into downtown Manhattan would be relatively simple.

In case it's skipped your attention, Israel's West Bank problem has spawned a growing number of fanatics—people who are dedicated to killing themselves and as many as they can take with them. There is no bargaining with these people. They're mad and they're not going to take it any more.

And if you figure that giving the West Bank back to the Arabs will help, please don't forget that there are a bunch more fanatic groups—many angry with America. New York City, where a nuke could wipe out two or three million people and injure 13 million more, is a very attractive target.

A few years ago I had a visit from a chap who had worked for me back in 1962. Nice chap. He'd gone into social work in Brooklyn. Well, he had a strange story to tell when he visited about 15 years

Continued on page 78



QSL OF THE MONTH

To enter your QSL, mail it in an envelope to *73*, WGE Center, 70 Rte. 202 N., Peterborough NH 03458, Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

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Catch of the day!

Have you been trawling the bounding main for a new product? We have just netted it—the TP-38 microprocessor controlled community repeater panel which provides the complete interface between the repeater receiver and transmitter. Scuttle individual tone cards, all 38 EIA standard CTCSS tones are included as well as time and hit accumulators, programmable timers, tone translation, and AC power supply at one low price of $595.00. The TP-38 is packed like a can of sardines with features, as a matter of fact the only additional option is a DTMF module for $59.95. This module allows complete offsite remote control of all TP-38 functions, including adding new customers or deleting poor paying ones, over the repeater receiver channel.

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LETTERS

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THUMBS UP

I wanted you to know how much I enjoyed the July 86 [Clubs] issue of *73*—so much that I've taken a two-year subscription. There was so much of interest in there that I couldn't put it down all week while on vacation. Please keep up the good work.

Bud Gray W1HMT
Windham NH

THUMBS DOWN

Whoever decided to make August 86 [Packet] a one-issue magazine should be fired as a liability to Wayne Green Enterprises. I am paying for a *ham radio* magazine, NOT a computer magazine.

Dennis Bernier WA1WIA
Pawtucket RI

THUMBS UP

I am proud again to be a subscriber to a fine magazine such as your August 86 issue. Here in east Tennessee, packet radio has just begun to gain momentum. I have very little time to acquaint myself with the new and varied interests of ham radio. It is nice to pick up a copy of *73* and learn, first-hand, about these interests. It took a lot of courage to fill an issue of *73* with "pure packet," but I am glad that you folks were courageous. Your courage and your sense of adventure brought me back to *73* after a much too long hiatus.

John Dolan WC4M
Greeneville TN

THUMBS DOWN

You talk about getting new and young blood into ham radio—take a real close look at your August 86 issue. Do you really think a Novice or pre-Novice could understand one single word? Granted, packet radio is hot, but with whom? Amateur radio is a hobby . . . not a religion to be followed as the high priests (read old farts) dictate as the only road to salvation. What happened to the articles that could be read and understood by those who are new hams and those who wish to be new hams? What about easy, useful construction projects that some of us dumb bastards can understand? Let's have some of the old *73* and let's try to remember that we're all not electrical engineers.

Name withheld

"Pre-Novice" sounds like Cro-Magnon! Just because you couldn't figure it out doesn't mean that the rest of the world can't (excluding a few of the folks I hear on 75m). Packet is what a million young hackers are looking for . . . a new way to use their beloved computer. Trust me, they understand every word.—KW1O.

SWEPT AWAY

It was indeed a surprise when I received Stu Norwood's phone call informing me that I had won a Kenwood TM-2570A in *73*'s Powerhouse Sweepstakes. It was a surprise because I had not entered: My OM, Jim Wilcox K4JAP, had entered my name as well as his brother's. Needless to say, it was a great thrill to win such a great piece of Kenwood equipment.

I already have a Kenwood TH-21AT. It's been a very useful HT for me because it fits in my pocketbook and I can take it anywhere. Jim has a TS-930S. So you can see we're pleased with Kenwood.

We enjoy *73*, and I especially enjoyed the August 86 issue on packet, since this is an area I've become interested in lately. I haven't purchased any equipment yet, but the information in that issue will be helpful in making decisions. Keep up the good work.

Thanks for declaring me a winner. The TM-2570A is already up and running as a base station. Oh, and one last note: Jim asked me to say, "Welcome back, Wayne."

Judi Booker N4NMH
Falls Church VA

YOUNGEST YL

With regard to your QRX column in August, Her Royal Majesty Princess Raya of Jordan JY2RBH [born this year] has to be the youngest YL ham and perhaps the youngest licensed ham.

However, I congratulate Jill KA9VGW and wish her many years of happiness in ham radio.

John Manna WA2MTR
Bridgewater NJ

OK, how about "Youngest Active Non-Princess YL"?—KW1O.

THANKS, DI

Your artist, who signs himself DKR, has displayed a keen talent for showing us as we are. I'm talking about that picture on pages 36 and 37 of the July 86 issue. I hope we see more of his work.

Paul Schmidt W9HD
Bloomfield IN

DKR is Dianne Ritson, our multi-talented art director who designs our covers and does a hundred other tasks, too. Here's a look at Di.—KA1MPL.

W2NSD/Rx

Congratulations on your editorial regarding gutter language on the ham bands (June 1986). The treatment you prescribed is excellent, and I hope it is applied as often as needed. Keep up the good work.

Ivan T. Schultz K0GP
Humboldt IA

DEAR ARRL,

What a sad day it was when I opened my June, 1986, *QST* and found that the League has endorsed the proposal for enhancing the privileges of the Novice license! I don't really mind the 220-MHz and the 23-cm additions, but to give Novices 10-meter phone is preposterous! With the number of headaches and lack of control the FCC has faced from amateur radio as of late, not to forget the problems that the Citizen's Radio Service created, why can't Uncle Sam and the ARRL learn from past mistakes?

I certainly want more youngsters to enter amateur radio, and I speak first-hand since I entered as a Novice at the age of ten (I'm twenty-nine now). But the League certainly seems to be placing more concern on the quantity, rather than the quality, of new amateurs. With the declining number of Novices and declining ARRL membership, is the League taking the position that it is more important to stay financially secure and impress the government with the sheer number of licensed amateurs? I think the answer is yes.

A few phone privileges are fine; I can even remember using AM on 2 meters when I was a Novice. Use of CW and digital modes is great, too. But giving the Novices SSB in the 28.3–28.5-MHz segment is asking for trouble from the CB lids who will slide their 110% modulators up to the 10-meter amateur band and create chaos and frustration for *all* amateurs, both in the U.S. and abroad. The League has been so forward in preserving our precious band space, so why not support the use of the 50–54-MHz band for Novices, and increase the 6-meter population and justify our continued allocation that is threatened at this very moment?

Please, please reconsider the granting of 10-meter phone privileges to Novices, and put the emphasis on the *quality* of amateur radio operators, not simply the *quantity*.

Paul Passman WB0BBC
Lenexa KS

Of course the ARRL endorsed Novice enhancement—the ARRL proposed it! (Actually, there were a number of petitions before the commission regarding expanded Novice privileges, but the text of PR Docket 86-161 is essentially the League's.) And it must have been an exceptionally sad day when you opened up the June, 1986, issue of 73 and discovered that we endorse it, too.

We need Novice voice on ten meters so that they can get a taste of what it's like to operate SSB on HF. There's already a "Novice" license for six meters—our current Technician class. The Techs aren't exactly shoulder-to-shoulder on six; there's no reason to believe the Novices would populate it either.

Finally, you'd better believe

For the Finest in Repeaters, Go with the Leader—

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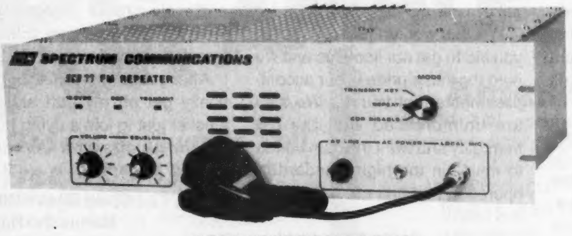

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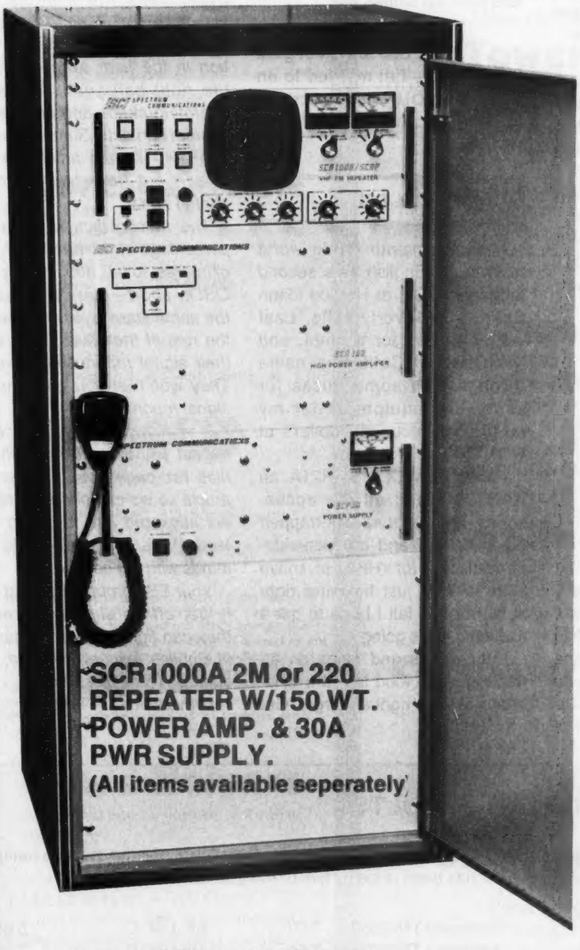

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we're worried about sheer numbers. Maybe you haven't noticed, but amateur radio has experienced "negative growth" for the past several years. If something isn't done very quickly to reverse this trend, there soon will be nothing to stop the commercial radio concerns from taking the spectrum from us that they want so badly. In Washington, it's sheer numbers that count. —KW1O.

A/S OK

I would like to bring to the attention of your readers an exceptional amateur radio company, The Antenna Specialists Company of Cleveland, Ohio. After contacting A/S regarding a replacement part for my 10-year-old 5/8-wave, 2-meter trunk-mount antenna which had developed an internal short, I received the required parts free of charge in less than nine days. I am very impressed with this type of service and highly recommend A/S products to all.

Michael Weber WB8RDN
Sterling VA

GLASS HOUSES

Though once considered a man's hobby, amateur radio is now seeing a growing influx of YLs. Some narrow-minded OMs are voicing their concerns about the growing number of licensed YLs and the long-term effect on "their" repeaters. Many have expressed fears that the bands will soon be overrun by inexperienced YLs who will turn two meters into a glorified CB band filled with meaningless gossip.

To be adequately prepared for entering the world of repeater operations, I, a newly licensed Technician, turned to the FCC manual on Rules and Regulations. A basic description of repeater operation was given, and it also suggested that I monitor the local repeater to observe accepted operating procedures. The following is a list of accepted topics compiled from my monitoring. You may talk about:

- Baseball, football, cheerleaders, and the girls in the stadium
- Your favorite restaurant, the foods you are most hungry for, how long it has been since your last meal, and even recipes
- The weather conditions, amount of rainfall, and cloud formations
- The stars and the moon
- Car repairs, home repairs, or even vacations—but if you're a YL don't mention household chores or you'll be accused of trashing the airwaves
- Your wife's moods, dermatology problems, and dental problems
- Gardens, grandchildren, pets, or the old lady back at the QTH (I thought Q signals were for non-verbal communications)
- Golf, cycles, fishing, guns, or photography
- (On Sunday) church, choirs, attendance, ministers
- Road construction, the car in front of you, and the car behind you—but if you're a YL, don't mention that you're mobile chauffeuring children or you'll be accused of misusing the repeater

OMs are allowed to ask: What's up? What's happening? How are things with you? If you're a YL, you'll be accused of gossiping and it will be implied that you should stick to the telephone.

If something is funny, don't laugh or you'll be accused of being tacky. HI, HI is acceptable. Don't giggle or you'll be accused of flirting.

It is acceptable etiquette for an OM to sneeze, cough, clear his throat, or burp into a keyed mike.

We YLs worked just as hard as you did to get our licenses and we hold the same pride in our accomplishments that you do. We also are unimpressed with the CB mentality and want the ham bands to maintain the high standard of operation that first attracted us to this hobby.

So, OMs, please listen first before you cast stones.

Name withheld
due to lack of guts
(I'm no fool—I'm married to an Extra-class OM who subscribes to this magazine.)

QSL ESL

I teach seventh grade world history and English as a second language (ESL) at Horace Mann School in Beverly Hills. Last year I applied for a grant, and the State of California came through with some bucks for shortwave equipment for my classroom. Your tax dollars at work.

I bought an ICOM IC-R71A, an IC-R7000, and all the accessories. I put up a 42-foot trapped dipole for HF and a super-wideband discone for VHF/UHF. I have a lot of kids just listening right now, but this fall I hope to get a licensing class going.

Your efforts and ideas on attracting new blood into the amateur ranks are right on target. Get them at this age level. Increase Novice privileges. Develop and distribute a comic book. All good concepts.

A lot of hams simply take themselves too seriously. They detail their trivial daily activities. They're snobbish to the newcomer. They endlessly explain personal problems which are of very limited interest to anyone else.

After years of listening, I didn't finally get off my duff and earn a ticket just to join a dying hobby. I think things *can* be turned around.

Craig Dible KB6LAK
Marina Del Ray CA

Sure, there are a lot of dim-wit ops—and it soon becomes obvious there's no sanity section in the ham exam—but with the right bait you'll find some charming chaps and have plenty of great contacts. Someday someone will write an article on how to sort out the wheat from the chaff. I hope.

The merciful thing is that a high percentage of the hams with little of interest to talk about make their QSOs short—merely repeating the same litany over and over for the rest of their lives. Give them their signal report and move on. They won't let you go without a signal report.

If you do have any success I expect you to write more than a nice two-page note. I expect an article so we can get more teachers suckered into following your lead. Poison their miserable little minds with the ham virus!

Your ESL groupies should really get off on shortwave, where they can fight off their immersion in English (except at home, presumably) for a few hours.

I have written.—Wayne.

PRODUCT REPORT RESULTS

The following is a compilation the Product Report cards we have received. Equipment is rated on a scale from 0 to 9, and the average rating for each product is shown. A piece of equipment is included in the list only if it has been rated by five or more readers.

AEA PK-64	8.22
Azden PCS-3000	7.00
Azden PCS-4000	6.00
Butternut HF6V	8.80
Drake TR-7	7.86
Heath HW-101	6.40
ICOM IC-02AT	8.25
ICOM IC-04AT	7.60
ICOM IC-2AT	8.42
ICOM IC-25A	5.75
ICOM IC-251A	7.20
ICOM IC-27A	6.00
ICOM IC-27H	7.75
ICOM IC-3200A	8.40
ICOM IC-37A	7.00
ICOM IC-701	6.25
ICOM IC-730	7.67
ICOM IC-735	7.22
ICOM IC-745	7.88
ICOM IC-751	8.27
ICOM R-71A	8.25
Kenwood TH-21AT	8.22
Kenwood TM-2550	7.00
Kenwood TR-2600A	7.84
Kenwood TS-430S	8.36
Kenwood TS-440S	8.00
Kenwood TS-711A	7.75
Kenwood TR-7950	8.00
Kenwood TS-830S	7.75
Kenwood TR-9130	8.00
Kenwood TS-940S	8.77
Kenwood TW-4000A	6.25
MFJ 941C	5.66
MFJ 941D	7.50
MFJ 949C	8.33
Microlog AIR-1	8.33
TAPR TNC-2	7.00
Tempo S-15	8.00
Yaesu FT-208R	8.33
Yaesu FT-209RH	7.00
Yaesu FT-757GX	7.88
Yaesu FT-980	8.83

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Terms: No personal checks accepted. Prices do not include shipping. UPS COD fee: $2.35 per package. Prices subject to change without notice or obligation. Products are not sold for evaluation. Authorized returns are subject to a 15% restocking and handling fee and credit will be issued for use on your next purchase. EGE supports the manufacturers' warranties. To get a copy of a warranty prior to purchase, call customer service at 703-643-1063 and it will be furnished at no cost.

More Helpers

- **Marine** radios by Regency Polaris and Icom
- **Commercial** Land Mobile by Yaesu and others
- **Telephones** by AT&T, Cobra, Southwestern Bell, and Panasonic
- **CBs** by Uniden, Midland, Cobra
- **Radar Detectors** by Uniden and Whistler

Much More in stock! Send $1 for our current Buyer's Guide-Catalog.

Antennas

HF, VHF, SWL, scanner, marine, & commercial for Mobile or Base.
Cushcraft
Mini-Products • Larsen
B&W • Van Gorden
Butternut • KLM
Mosley • Hustler
Telex Hy-Gain

Towers

Unarco-Rohn, Hy-Gain, Tri-Ex
Ask for special quotes on package deals including cable, guys, connectors, turnbuckles, etc.

Hy-Gain Rebates

$100-200 rebate from manufacturer on selected towers and $50 rebate on HF antenna/rotator combinations. Call for models. Offer good July 1-September 30, 1986.

Accessories

Phillystran
Kenpro • Alliance
B&W • Telex Hy-Gain
Daiwa • MFJ
Bencher • Amphenol
Astron • Welz
B+K Precision

Amplifiers

Diawa • Ameritron
Amp Supply • Vocom
TE Systems
Tokyo Hy-Power

Computer Stuff

Packet Radio
Hardware and Software for RTTY/Morse
Hal • Kantronics
Microlog • MFJ
Ham Data Amateur Software.

Shortwave

Sony
Panasonic
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Special Prices
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Virginia Store—October 10 & 11
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Virginia Store—October 11

YAESU WEEKEND

NEW FT-767GX
All-mode transceiver. Cat system.

FT-757GX
HF XCVR/Gen. Coverage Receiver.

NEW FT-727G
Dual-band handheld for 2m/440 MHz

NEW SOFTWARE
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Kenwood CASH REBATES ©

TS-440S	$\$50^{00}$
TM-2570A	$\$40^{00}$
TS-430S	$\$25^{00}$
TR-2600A/3600A	$\$15^{00}$
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HF XCVR/General Coverage Receiver.

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2m- 27A, 27H, 271A, 271H
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Small, light HTs for 2m or 440 MHz. 10 memories and scan functions.

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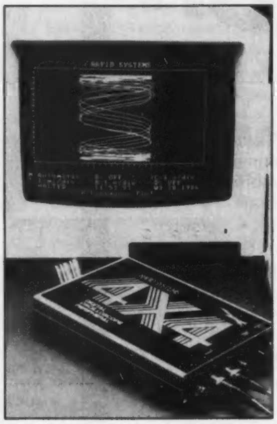
Handhelds for 2m, 220 MHz, 440 MHz, 1.2 GHz

IC-A2 in stock
Aircraft handheld

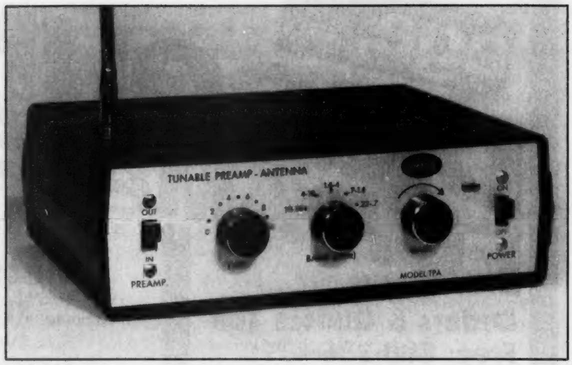
NEW PRODUCTS

Number 21 on your Feedback card

Shure's 550L microphone.



The 4X4 digital oscilloscope from Rapid Systems.



Ameco is back with their Tunable Preamp Antenna.

NEW SHURE MIKES

Shure Brothers has introduced a new communications microphone to their line. The model 550L is similar in design to the well-known model 450, and is designed for base-station use. The mike is brown and silver and comes with an omnidirectional cartridge.

For more details, check Reader Service number 204.

RAPID SYSTEMS 4X4

A new digital oscilloscope peripheral for IBM-compatible computers has been announced by Rapid Systems. The 4X4, which retails for $1,995, features four channels of simultaneous sampling with a 32K data buffer on each channel. The A/Ds have programmable gains from 10 mV to 20 V per division, sampling rates from 0.1 Hz to 500 kHz, user-definable pre- and post-trigger buffers, and both analog and digital triggers. The menu-driven software includes a custom 140 x 288 color display, zoom from 1–2,000X, and a voltage cursor.

For complete details, mark Reader Service number 206.

SSB SQUELCH

A new voice-operated squelch module (VOS) has been announced by Naval Electronics. The VOS recognizes speech signals with a syllabic rate detector; when speech is present, the radio's speaker is turned on. The small board installs in most modern receivers and transceivers.

For more information, please check number 210 on the Reader Service card.

MIRAGE 1260 BEAM

A new yagi for 1260–1300 MHz is available from Mirage/KLM. The 1.2-44LBX provides 18.2 dB gain on a 12′ 4″ boom, with a wind load of only one square foot. Vswr is better than 1.5:1 over the specified bandwidth. The antenna requires no tuning and comes from the factory assembled and tested.

For complete details, check Reader Service number 203.

SAMS COOKBOOK

The third edition of the popular *IC Op-Amp Cookbook* by Walter Jung is now available from Howard Sams and Company. The book contains over 200 practical circuit applications, material on instrumentation amplifiers, information on chopper-stabilized drift-trimmed BIFETS, and an appendix of manufacturer's data sheets.

For more information about this and other Sams books, please check Reader Service number 205.

AMECO BRANCHES OUT

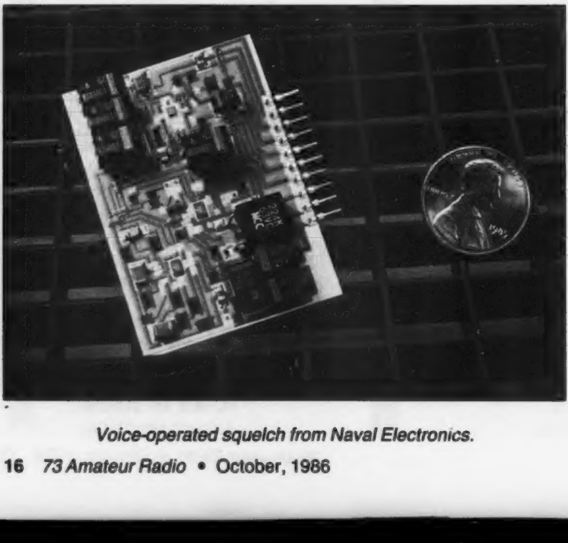
The familiar Ameco logo has resurfaced on their new Tunable Preamp Antenna. The TPA may be used both as a preamplifier or an indoor active antenna. The unit covers 0.22 to 30 MHz and uses a dual-gate FET for about 20 dB gain.

The TPA operates either on a 9-volt battery or an ac adapter (available for $7.50 from Ameco). The TPA, including a whip antenna, is $74.95. For complete details, mark Reader Service number 202.

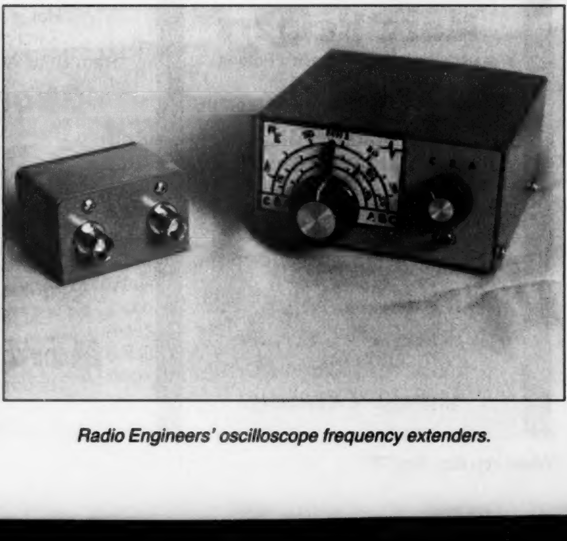
O-SCOPE FREQUENCY EXTENDERS

Radio Engineers has recently introduced two frequency extenders for oscilloscopes with low bandwidths. The HFX-1 contains an rf oscillator and a broadband mixing circuit to allow a 5- or 10-MHz scope to display signals of up to 55 MHz. The HFX-2 provides the same coverage when used with an external rf generator. Both units have an impedance of 50 Ohms and use BNC connectors.

For complete details, please



Voice-operated squelch from Naval Electronics.



Radio Engineers' oscilloscope frequency extenders.

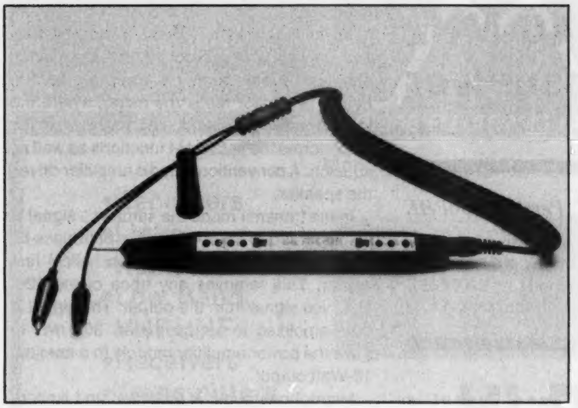
What's Gray and Green and heard all over?

(Answer on page 81)

What's Gray and Green

and heard all over?

(Answer on page 81)



Davle Tech's PRB-50 digital logic probe.

The Regency HX1500 55-channel VHF/UHF scanner.

mercer
9301

The Mercer model 9301 DMM.

check Reader Service number 208.

WINNER'S EDGE SOFTWARE

Winner's Edge Software has announced a new module for their Contester II computer-aided contesting system. The CQWW module is designed for use during the *CQ* Worldwide phone and CW contests. It keeps the operator up to date on contest statistics such as running score and the number of QSOs and multipliers (both in the contest and on the current band), as well as automatically logging contacts, duping, and even sending CW.

The CQWW module ($16.95) requires the Contester II Basic system ($39.95) and a Commodore C-64 or C-128. For more information, check Reader Service number 214.

DAVLE DIGITAL PROBE

Davle Tech's model PRB-50 digital logic probe tests the logic state of TTL circuits, as well as under- and over-voltage conditions in CMOS and other voltage-sensitive ICs. The unit indicates signals up to 50 MHz and has a pulse width sensitivity of 10 ns. The probe operates on from 3 to 18 V dc.

For complete details, check Reader Service number 211.

XCELITE STRIPPER

Xcelite is now marketing an automatic coax-stripping tool which removes outside insulation, braid, and dielectric simultaneously or one at a time. The unit handles RG-178 up to RG-6 with color-coded cassettes which slip in and out of the tool in seconds. Pre-adjusted models are also available for single-size applications.

For more information, please check Reader Service number 212.

REGENCY HX1500

Regency Electronics has announced the HX1500 55-channel hand-held VHF/UHF scanner. The HX1500 covers 29–54 MHz, 118–174 MHz, and 406–512 MHz. Stored channels may be grouped into any of four banks for ease of access—all of the police channels in one bank, repeater pairs in another, and so on. Other features include dual scan speed, a priority channel, scan delay, and direct channel entry from the sealed keypad. The HX1500 retails for $369.95.

For complete details, mark number 213 on the Reader Service card.

MERCER 9301 DMM

Mercer Electronics, a division of Simpson, is now offering the model 9301 DMM ($69), a 3-1/2 digit general-purpose instrument with 0.25% accuracy on all dc ranges. It measures up to 1,000 Volts dc, 750 Volts ac, 10 Amps ac or dc, and 20 megohms. Resolution is 100 uV, 0.1 uA, and 0.1 Ohm. Other features include an audible continuity checker, a diode test position, and a battery life of 2,000 hours.

For more information on this and the entire line of Mercer products, check number 207 on the Reader Service card.

FREE HEATH CATALOG

The new Heathkit catalog is now available. Completely redesigned, this edition includes many new kits, as well as a line of beginner's kits priced at less than $5.

For your free copy, check Reader Service number 209.

Xcelite's new coaxial stripper.

Heath has just the kit for you...whether you're just starting out or have been putting them together for years
Heathkit

Free catalog available from Heath.

73 Review

Dick Smith 440-MHz Mobile Transceiver

UHF AMATEUR TRANSCEIVER
VOLUME
SQUELCH
POWER SIGNAL
-5 SIM +5
FREQUENCY
1 2 3
NORMAL +5kHz
ANTI REPEATER
MIC
DSE

by Allan J. Perrins WB6PHE

Dick Smith Electronics
PO Box 8021
Redwood City CA 94063
Price class: $170

You say you'd like to get on 440 mobile but all the new radios are too pricy? You say you don't need all those fancy whiz-bang features like scanning, programmable offsets, priority channels, and memories? Well, how about a good, basic, no-frills radio for less than $170. There is a catch—it's a kit.

Dick Smith Electronics has introduced a 440 companion to their popular 2-meter kit. This is a newly designed radio, not just a retrofit of their Australian model (they use 430–440 in Australia).

Full coverage from 440 to 450 MHz is provided in 5-kHz steps with a switch for ±5-MHz transmit offset or simplex operation. Also provided is a momentary push-button labeled "Anti-Repeater" that allows you to monitor the repeater's input frequency to see if you're within simplex range. Ten Watts of power out is nominal; typical receiver sensitivity is around .4 uV or better.

The kit comes complete with a mobile mounting bracket and a standard microphone. An optional 16-button DTMF microphone will be available soon. A matching base-station power supply is also available (K-6310—$39.95).

No provision was made for subaudible tone (PL) but a modification to add it will be outlined in the construction part of this review.

Appearance

The front and rear panels are die-cut from PC board, painted, and silk-screened. Front-panel layout is identical to the 2-meter version. An SO-239 is provided on the rear panel for the antenna connection, but purists may wish to replace it with an N connector. There is also an external speaker jack. The case is the same as the 2-meter kit—black plastic with an adjustable mounting bracket. The microphone provided, although comfortable and stylish, is internally baffled and designed to be a "communications" type with very limited response. More on this later.

Circuit Analysis

Don't worry, I'm not going to get complicated. Refer to the block diagram (Fig. 1) and follow along. By the way, a detailed theory of operation is included in the manual, which helps in troubleshooting.

The synthesizer is a modification of a basic PLL. The reason for this is that it is not practical to divide a binary number corresponding to 440 MHz directly. Instead, an offset oscillator is used so that the difference between the vco output frequency and the offset oscillator will be divided by a selected number (front-panel thumbwheels) and then compared to the reference oscillator in the PLL phase comparator. In this case, a 10.24-MHz oscillator is divided by 2,048 to give a reference of 5 kHz. The resultant error voltage is used to "steer" the vco to the proper frequency output.

The vco operates at a nominal 220 MHz. It is doubled to provide a 420-MHz signal, which is used in the receiver as the first i-f. Antenna input to the receiver passes through a two-section helical resonator, then enters an rf amplifier. From there a second two-section helical resonator feeds the mixer, where the input signal is converted to 21.4 MHz. A single IC performs the second i-f functions as well as squelch. A conventional audio amplifier drives the speaker.

In the transmit mode the same vco signal is also doubled to 440 MHz and is bandpass-filtered by yet another two-section helical resonator. This removes any trace of the 220-MHz vco signal from the output. The signal is then amplified to approximately 300 mW to drive the power amplifier module to a nominal 10-Watt output.

Microphone audio is amplified and limited, then a sample of audio is routed to a varactor diode in the vco circuit to produce FM.

Diode switching is used in the antenna filter network to handle the T-R chores.

Construction

As the Dick Smith ad states, "This kit is for advanced builders only!" And, I might add, not for the timid, either. When your kit arrives, you will find lots of bags of parts. Forget your preconceived "Heathkit" notions of parts being in coded bags—these aren't. Of course, you're also not paying someone to put those parts in the coded bag, either. If you're a little slow with resistor color codes now, you won't be by the time you finish this kit.

Many of the coils will have to be fabricated by the builder. This really isn't as hard as it sounds. Just use a drill bit of the proper diameter as a winding form. Take your time and refer to the drawings in the manual. When mounting the coils, keep the leads short.

This is a complicated kit and component layout is rather dense, so before you start construction I suggest that you read the manual from cover to cover three times. Be sure to read the errata sheet as well. It contains additional information on construction and alignment. When you finally get the soldering iron warm, repeat to yourself "take your time, do it right" ten times aloud. If you are not sure where a part goes, skip it for the time being and go back to it later when the rest of the parts in the area have been installed. Remember to check off in the space provided the parts you have installed. Don't forget to install all the jumpers (they're called "links") shown on page 54 of the manual.

If you choose to socket the DIP ICs, be sure to use a very low profile socket for IC2, as it is directly under the front-panel thumbwheel assembly. I didn't, and ended up having to change it later when I tried to mount the front panel.

Speaking of the front panel, the instructions are on page 55 of the manual and the wiring is on page 66. Same thing with the back panel—instructions on 56, pictorials on 55 and 67. I found this a bit inconvenient. The manual for the 2-meter rig was much better in this regard. DSE informs me that the second printing of the manual will have these pages rearranged to be less confusing.

Only tack-solder the front and rear panels

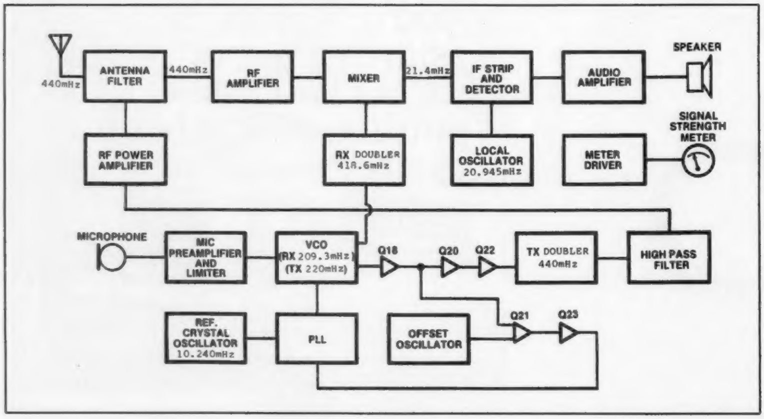


Fig. 1. Block diagram of the DSE 440 mobile rig.

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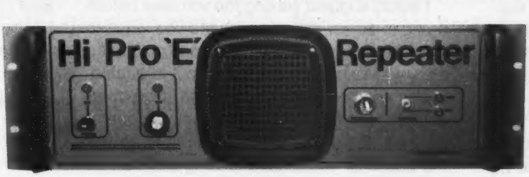

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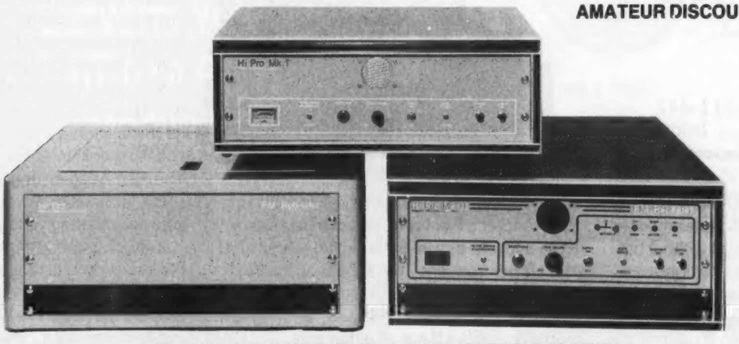

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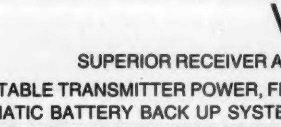

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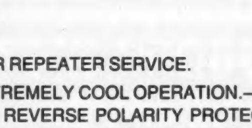

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until all alignments have been completed and the unit has been fully checked out. I made that mistake as well, and desoldering one of those panels was not fun. While on the subject of front/rear panels, if you need more than one PL frequency, you might want to add a stereo mini-jack on the rear panel for an external encoder. Of course, you could always cheat and use the external speaker jack—as I did.

And speaking of PL, the place I injected tone was the junction of R22 and R23. The wiper of the deviation pot could also be used. Use a piece of shielded cable to connect to the rear-panel jack. If you need only one PL frequency, secure the encoder (using double-sided tape) to the inside of the same case half as the speaker and connect it using shielded cable. Switched TX voltage can be taken from either side of R149.

Alignment

The alignment instructions are very good and no problems should be encountered, assuming the unit was constructed properly. Presetting the small red variable caps can be a little tricky, so pay close attention to the drawing in the errata sheet. You should be able to attain reasonable receiver sensitivity doing the adjustments with a weak over-the-air signal, but alignment using a signal generator is preferable if you have one available. My unit ended up at .3 uV for 12 dB Sinad, which is more than good enough for repeaters.

Transmitter alignment should not be attempted with a dummy load mounted on the back of the radio! Rf will leak back into the radio and will interfere with PLL adjustments. Locate your dummy load about three feet away and you won't have any rf feedback problems. Be sure to perform the broadband transmitter alignment (page 64 of the manual) carefully and don't forget the additional step included in the errata sheet. If you do it right, the power should be just about flat from 440 to 450. Mine made 12 Watts across the band, and the spectrum analyzer showed no spurious signals at all. Not bad!

I would suggest waxing the vco area before trying to adjust deviation, as the vco tends to be just a little harmonic before you "pot" it. An easy way to melt wax is to place it in a tablespoon and heat it over an electric stove burner. Don't use gas—remember that wax burns. Be sure that the vco shield is close to the PC board or you'll have leaking hot wax all over the board. A shield of double-sided PC board above and below the vco housing also helps.

Transmitter modulation should be done last. You may find that even when you get the deviation adjusted for 5 kHz, the radio still sounds "loud." I suspect that this is because the microphone amplifier is the same as the one in the 2-meter radio, whose vco output is not doubled. There are several changes suggested in the errata sheet that will improve the loud sound and compensate somewhat for the "communications" type microphone.

Operation

Frequency selection is handled by pushbutton BCD switches on the front panel that are much better than the ones in the 2-meter kit. These have a very smooth feel to them and are easy to use, even in a mobile environment. Receive audio could use a little more "punch." Modifying the amplifier for a little more gain would help, as does an external speaker. Adjacent channel rejection is very good and the unit does not seem to be susceptible to intermod.

On-the-air reports of transmit audio ranged from "tinny" to "thin and hollow," although I found one guy who thought it sounded just fine. The mods in the errata sheet will help, but the big culprit is the microphone. One report said it sounded like the two-way radio in "Adam 12," and that is what is referred to as "communications quality." I suppose it's a matter of personal preference, but I like my audio to sound better than that. An old microphone from the junk box made a major improvement. My understanding is that DSE is researching other microphones to replace the one presently supplied.

Summary

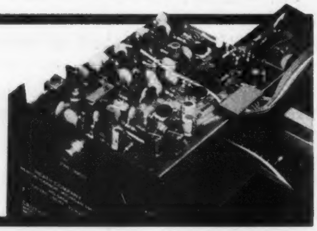
This was a fun kit to build, though the experience gained in building the 2-meter kit previously was an advantage. It's not a fancy radio, but I don't need a fancy radio and a fancy price tag. Since I built it myself, I suspect that I can also fix it myself should something ever go wrong. That would be hard to say about any of the "rice rockets" that I've seen lately.

This 440 rig delivers excellent value for the price: an adequate output power level and a suitably sensitive receiver. Mobile operators may find that a little extra filtering may be in order if the power leads aren't run directly to the battery. I had problems using the cigarette lighter plug in my Buick—too much hash, especially with the air conditioning blower on. Running leads directly to the battery eliminated all but a little alternator whine, and I can live with that. I defy you to find another new, fully synthesized, UHF mobile radio for $170.■

Heath HOA-5404-1 Pan Adapter

by Marc Stern N1BLH

Heath Company Dept. 011-442
Benton Harbor MI 49022 Price class: $100



Building the Heathkit HO-5404 Station Monitor without the Pan Adapter module (HOA-5404-1) is like making toast without butter—it will work, but it just won't be right.

Imagine trying to use a monitor scope to tune in a weak CW signal near your frequency—but without a Pan Adapter. You may be able to do it by watching the trace of the pattern generated by the scope's internal sawtooth generator, or you may be able to do it with the RTTY setting. But if you do, you'll be very lucky because you still really won't have any idea where the signal is in relation to yours and you may actually tune in a different, slightly stronger signal than you had wanted. The result could easily be some missed rare DX because you tuned to the wrong signal.

A Pan Adapter module would eliminate this. Because it interfaces directly with the i-f strip of your receiver or transceiver, any signals within the i-f passband will be indicated on the Pan Adapter's display trace. With the Heathkit HOA-5404-1, any signals within about 100 kHz of your frequency will appear on the trace. The frequency you are on is indicated in the center of the scope's graticule, and signals below and above it are on either side.

With the Pan Adapter module installed, you would be able to match your frequency to that of the station you are attempting to contact and establish contact.

The Pan Adapter module is also invaluable in another way. Let's say someone is QRMing your signal. The Pan Adapter module would indicate where the offending station was in relation to yours, and you would then be able to turn your beam—providing you have a beam for that band—and get a heading on the offending station.

Of course, even if you didn't have a Pan Adapter module installed in your scope, you would still be able to use the scope quite handily for monitoring phone signals and RTTY and checking transmitter performance. But the Pan Adapter adds a great deal of capability.

A one-board project, the HOA-5401-1 is meant to be installed within the HO-5404 Station Monitor Scope. Provisions are made for its installation on the upper right rear of the chassis (looking at the scope from the front). The Pan Adapter interfaces with the monitor scope's circuit board through three connector pins, which bring voltage to the board.

A multi-colored, multi-conductor ribbon cable interfaces the module with the switches at the front of the scope. Be careful when you prepare the ribbon cable to cut it exactly as the instructions note. The reason precision is needed is that the cable must bend at a 90-degree angle so that it can fit into the edge connector. If the cable isn't cut correctly, it won't seat correctly with the edge connector pins on the circuit board.

As you would expect with Heathkit products, there's very little left to the imagination. Everything is arranged logically and the instructions follow suit.

Like nearly every modern Heathkit, the transistors, capacitors, integrated circuits, resistors, chokes, and anything else needed are arranged logically in the box. Parts are stored

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in separate modules until you reach that particular step.

Even with this type of organization, working slowly will ensure that the kit will go together and work correctly on the first try. But if it doesn't, you can easily work back to the point where you made your mistake by simply retracing your steps.

For example, I found that after I'd assembled the project it wouldn't fire correctly. As I went through the troubleshooting routines, I found one of the key transistors wasn't working—no voltage—and I substituted my own for it. This cured one problem and I thought I was on my way, but the adapter hid a second, much more frustrating problem that resulted in several long-distance calls to customer assistance. In fact, the Pan Adapter ended up back in Benton Harbor. The reason it did will become apparent shortly.

As you work with the oscillator section of the board, you soon realize that the key circuit is the one containing transistor Q310. It is the crystal oscillator circuit, which operates at a frequency of 3.395 or 8.830 MHz. These frequencies cover many of the major rigs on the market. This circuit places the Pan Adapter's pip on the screen at the tuned frequency and tells you where your rig is tuned in relation to others.

As you're building this section, you run into a couple of capacitor insertions that look puzzling. Instead of two holes, there are three and you are instructed "to use the holes that best fit the capacitor supplied with your kit." Evidentally, this instruction is incorrect because I couldn't get the oscillator section to oscillate, although I used the capacitor supplied and used the "holes that best fit."

So, after about a week of troubleshooting, I sent the kit back to Benton Harbor. On its return, the technician who worked on it informed me my choice of capacitor holes was incorrect. Since this is the case, I would urge Heathkit to correct the documentation and instructions.

Another troubling error occurred in the information sheet describing the intermediate frequencies of various transceivers. As you look at the listing for Kenwood—the Pan Adapter was set up to work with a Kenwood TS-520SE—you notice something interesting: Just about all the i-f frequencies are listed as 8.830, except the 520. And, as most people know, the 520 was a less expensive version of the 820 and one would wonder why essentially the same rigs would have two differing i-f's. It doesn't make much sense, does it?

I thought so, too, and I explored the schematic thoroughly and came up with the conclusion that the Heath information sheet was wrong. I'm happy I took the time to do the detective work beforehand; with the amount of componentry on the printed circuit board, it would have been a job to desolder the components needed for the 3.395-MHz i-f and insert the new components.

In more than five years of having built various Heathkits, I haven't run across such a glaring error before, and I would urge Heath to check documentation more closely before it gets a final approval.

And, speaking of the documentation, it took me more than an hour to make all the changes needed to update the manual to reflect new components. It probably would have been easier for Heath to rewrite the brief manual, rather than rely on the buyer to do it.

That buyer had better be an intermediate level kit builder because the Pan Adapter is definitely not a kit for beginners. You have to build the Monitor Scope first and make sure it is aligned before building the Pan Adapter. But, like all Heathkits, the builder is led step by step through the building process with explicit detail.

In operation, the scope and the module work very well together. I was able to find signals and move over to them very easily. It also helped me find a clear frequency quite easily, which isn't easy on 20 meters these days.

It is actually simple to use and merely takes pressing three buttons—two at the same time—on the front of the scope to fire up the Pan Adapter. Simply pushing SSB, RTTY, and 100 kHz swings the Pan Adapter into action. There's a marker pip that indicates where you are in relation to the other stations in the passband of your radio.

Be aware, though, that you have to connect the module to the i-f of your transceiver or receiver. It's easy to do and Heath supplies the decoupling capacitors and instructions on how to do it. They also supply the miniature RG-174 coax to make the connection.

In the final analysis, the Heathkit Pan Adapter module is a worthy addition to the HO-5404 Monitor Scope. In fact, I think it should be included as part of the whole kit, rather than being an extra cost option at $99.95. Without it, the kit is like dry toast. It's filling, but isn't nearly as good.

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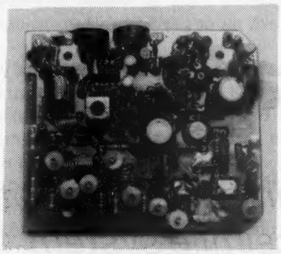
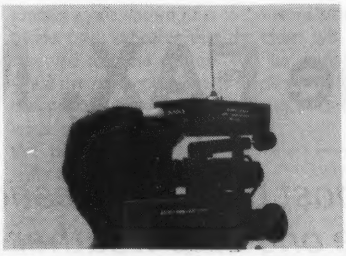
TOM W6ORG MARYANN WB6YSS

THE "KREEPIE PEEPIE" ATV TRANSMITTER





ROSE BOWL 10K RACE
WB6YSS

KPA5 1 WATT ATV TRANSMITTER BOARD FEATURES:

- ★ 1 watt pep minimum RF output on sync tip.
- ★ Full color and sound on one small 3.25 x 4" board.
- ★ Composite video input from camera, VCR, etc.
- ★ Runs on external 13.8 vdc at 300 ma supply or battery.
- ★ Wired and tested board covers 421 to 439 mHz.
- ★ Supplied with one xtal on 426.25, 434.0, or 439.25 mHz but capable of 2 freq operation with the addition of 2nd xtal (add $15). Other 70cm freq. available on special order.
- ★ Mic input from a low Z dynamic and line level audio input found in most portable color cameras, VCRs, or home computers provided.
- ★ Schematic and application notes supplied for typical external connections, packaging, and system operation.
- ★ Price delivered via UPS surface in the USA is only **$159.** Technician class amateur license or higher required for purchase and operation.

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1. PORTABLE CORDLESS TV CAMERA. No heavy VCR to lug around or cable length limitation. You can even use your home VCR rather than a portapak. Now you can creep around and peep thru your camera more easily. Gives good pictures up to a mile with simple whip, and 40 miles using beams in flat terrain.
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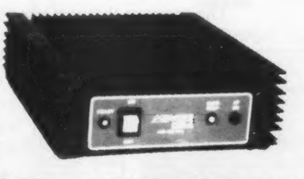
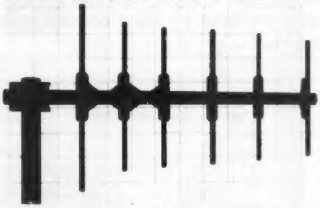
WHAT IS REQUIRED FOR A COMPLETE OPERATING SYSTEM? Either a **TVC-2G** or **TVC-4G** downconverter connected to any TV set tuned to channel 3, and coax cable to a good 70cm antenna to receive. Package up the **KPA5**, add 12 to 14 vdc, antenna, and any home TV camera, VCR, or computer with composite video output. **SIMPLE, EH?**

ATV DOWNCONVERTER 420 - 450 MHZ
TVC-4
P.C. ELECTRONICS





ACCESSORIES:

TVC-2G GaAsfet downconv. board wired & tested.. varicap tuned, 420-450 MHZ to ch3. Req 12vdc	$59
TVC-4G (TVC-2G in cabinet with 120vac supply)...	$99
TVCX-70 crystal controlled GaAsfet downconv.....	$99
specify in freq. & out on ch3 or 45mhz IF. 2 freq..	$114
Hammond 1590D Use for KPA5. 7.3x4.7x2".....	$17
1590C 4.6x3.6x2" aluminum box. Fits TVCX-70..	$11
800J 10 pin VHS color camera chassis connector....	$10
VOR Video (horiz sync) operated relay board.........	$25
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MIRAGE D24N-ATV 1in / 50 out all mode amp....	$219
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KLM 440-6 8dbd, 60 deg. beamwidth antenna.....	$62
KLM 440-14 11dbd, 48 deg. BW antenna..........	$77
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↙28

Gary Sargent WB8TPD
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Dayton OH 45430

Just the FAX, Ma'am

Answer ham radio's most popular question in agonizing detail with this complete one-chip weather facsimile system for your Commodore 64. Next month: Using your C-64 to control the weather!

My article "One-Chip Facsimile" (December, 1985) has kept a good number of Atari owners glued to their terminals, watching the weather. It soon became apparent that Commodore 64 owners were feeling a bit miffed at being left out of the fun. I bought a C-64 and modified the program to work with the new system; the result is this article.

What It Can And Cannot Do

This system will receive facsimile signals and display the received charts on the computer's monitor or TV screen in a space roughly two displays wide and three displays long. A joystick is used to scroll the screen around the chart. The received charts may be saved on disk or printed.

The system will properly display facsimile signals sent at a rate of 120 or 60 lines per minute (lpm). These rates (particularly 120 lpm) are used by most commonly heard stations.

Number 1 on your Feedback card

The computer samples each received line 480 times, and can display 512 lines horizontally. While this resolution can give good results, it is less than 50% of the resolution transmitted and gray tones are not used. Thus this system is more suitable for high-contrast, large-format weather charts than for satellite pictures and similar charts with much fine detail.

Figs. 2 through 4 are samples of charts that I have received at my location, and are representative of the system's capabilities.

System Components

The components of this system are: a good quality communications receiver with SSB capability, a simple tone-detector circuit, a Commodore 64 computer system, and a pair of computer programs, named Visifax and Utility.

Receiver Requirements

The receiver that you use should be a stable, good quality, general-coverage receiver with SSB capability. If your receiver provides acceptable ease of tuning and frequency stability for SSB voice signals, it should be usable for facsimile reception. I have used a Yaesu FRG-7 and a Sony ICF6500W with good results.

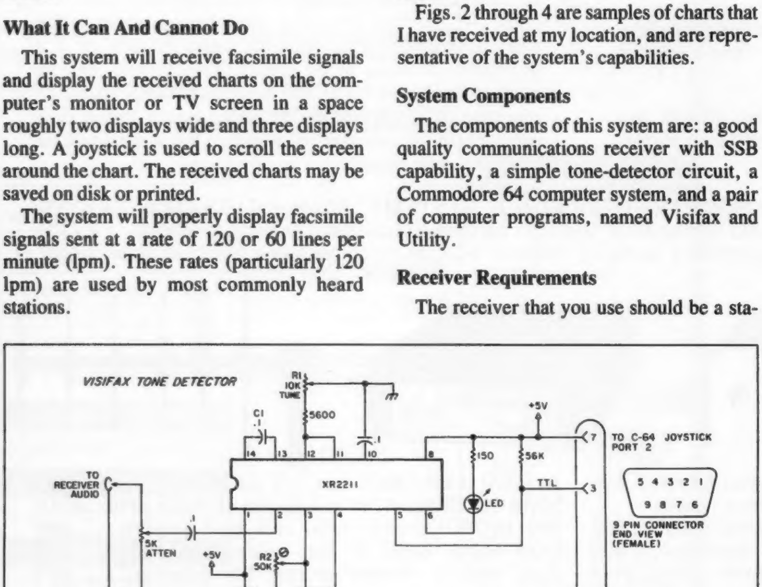


Fig. 1. Tone-detector schematic—one chip is all you need to display weather facsimile on your C-64.

The Tone Detector

The tone detector is a simple circuit that connects between the receiver audio output and joystick port 2 of the computer. The detector converts the facsimile tones to TTL pulses that the computer can use. The circuit, shown in Fig. 1, is based on the XR-2211 tone detector. R1 and C1 determine the detector's frequency, and R2 is used to adjust for the sharpest detail as a chart is being received. The LED serves as a simple but effective tuning indicator. The 5-V power source is supplied by the computer.

Most parts may be obtained from local outlets. The XR-2211 IC may be obtained from several mail-order parts suppliers (Jameco, Digi-Key, JDR Microdevices, etc.). The construction methods used are not critical.

The Computer System

The Commodore 64 computer and the two programs are the heart of the system and control all aspects of reading and displaying facsimile charts. This system is not usable on the VIC-20 computer because of memory requirements and other computer differences. A disk is required for program loading and (optionally) to hold received charts. An optional graphics dot-matrix printer may be used to produce a hard copy of the received chart; one was used to produce Figs. 2–4.

The Visifax Program

The Visifax program reads the tone detector's output signal at joystick port 2 and displays the received chart on the computer's monitor. Various options are available for the user to control the receiving process. The program is written entirely in assembly language; it is not shown here because of its length (about 25 pages). It is a complex program that uses several of the Commodore 64's sophisticated capabilities to do the job at hand.

The Visifax display consists of two lines of titles at the top and two lines at the bottom to enter controlling commands. The third line from the bottom contains one of two messages to aid in the command selection. The middle portion of the display consists of the received chart.

Because the C-64 uses the same circuitry to read the joystick ports as is used to scan the keyboard, it is difficult to use the joystick ports and keyboard simultaneously. Thus a standard joystick plugged into joystick port 1 is used to totally control the Visifax program once it is running. Upon ending Visifax, it is important to unplug the tone detector and joystick before attempting to use the keyboard. Failure to do so could result in a partial system lockup, but it will not damage the computer in any way. Should this occur, reset the computer by pressing and holding the RUN/STOP key and then striking the RESTORE key. The display will clear but memory will not be disturbed, and you may then key in whatever you desire.

Visifax Commands

The two bottom lines of the Visifax display contain eight commands. The one that you may direct the computer to respond to next is highlighted in green (gray with a monochrome monitor). Moving the joystick will allow any of the commands to be highlighted. Pressing the joystick's FIRE button will cause the highlighted command to be performed.

RESET

This command will start the process of displaying a chart. The chart is displayed as received from left to right and from bottom to top (so most charts are viewed normally...without your having to stand on your head!). The portion of the chart that is visible on the display is automatically set to the lower left corner. Subsequent RESET commands will reset the displayed chart to the left of the screen without altering the synchronization.

SYNC

Each SYNC command will have the effect of displaying subsequent received lines down the display about one half inch. This command should be used as required to center the received chart properly. Most stations precede charts with a short period of synchronizing lines that may be used for centering.

SKIP

Each SKIP command will increment the number of received lines to skip between displayed lines. This feature will allow compressing the received chart horizontally, fitting more of it onto the computer's screen. From 0 to 9 received lines may be skipped between displayed lines. I find that a skip value of 1 is used most often.

MODE

The MODE command will step through the three possible modes of operation, with the present mode shown next to the word MODE. Mode ONE indicates that the chart will be received and the process will be complete when the right-most line is displayed. Mode CONT allows the continuous display of charts, with one overlapping the last. Mode WAIT halts the display of any more received lines but does maintain synchronization. This feature may be useful to eliminate unwanted sections of a known chart.

CLEAR BUFFER

Selecting this command will simply clear the buffer that holds charts as they are being received, and thus it will clear the computer display.

SCROLL

This command is used as desired to control which portion of the received chart is being displayed. (As mentioned, the received chart is about six times the size of the display!) Selecting this command will change the message on the third-from-the-bottom display line from PRESS JOYSTICK BUTTON TO SELECT COMMAND to USE STICK TO SCROLL, BUTTON TO DISPLAY.

Now repeatedly bump the joystick in the direction of the chart that you wish to view. A pair of numbers (hexadecimal, and of the form row:column) next to the word SCROLL will indicate the portion of the chart that will be displayed. Row numbers range from 0 to 28. Column numbers range from 0 to 18. The lower left corner of the chart is at row 0,

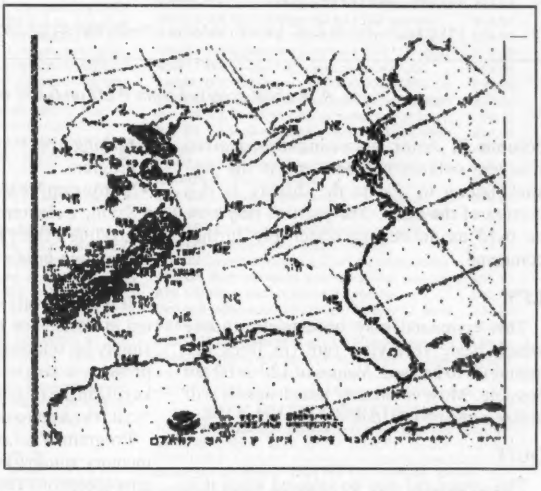


Fig. 2. A radar summary chart received from NAM on 3.357 MHz.

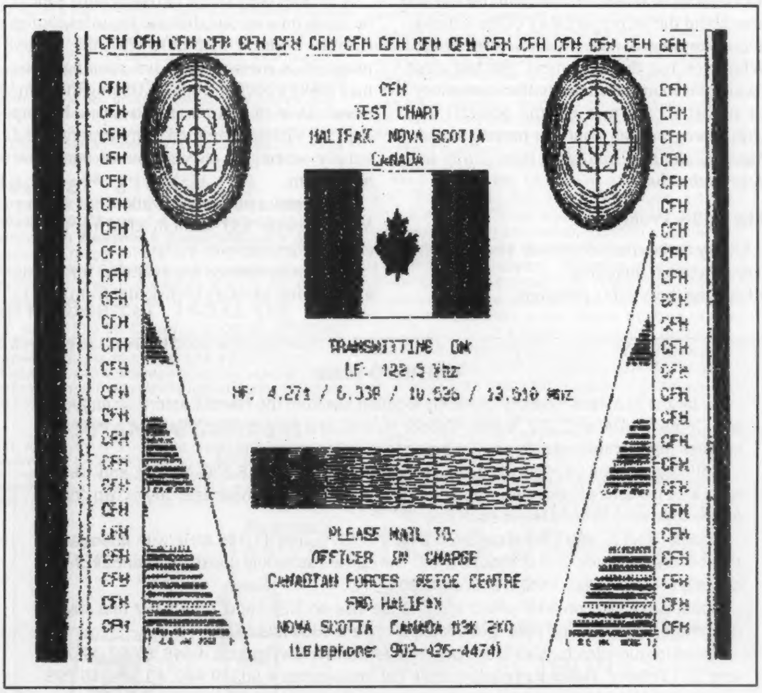
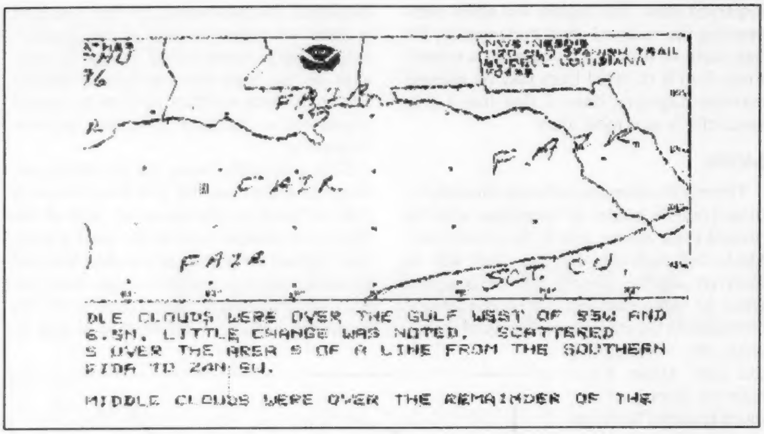

CFH CFH CFH CFH CFH CFH CFH CFH CFH CFH CFH CFH CFH CFH CFH CFH CFH
CFH
TEST CHART
HALIFAX NOVA SCOTIA
CANADA
TRANSMITTING ON
LF: 122.5 KHz
HF: 4.271 / 6.330 / 10.536 / 13.510 MHz
PLEASE MAIL TO:
OFFICER IN CHARGE
CANADIAN FORCES METOC CENTRE
FMO HALIFAX
NOVA SCOTIA CANADA B3K 2X0
(telephone: 902-426-4474)

Fig. 3. This test chart was received from CFH on 6.330 MHz.



DLE CLOUDS WERE OVER THE GULF WEST OF 95W AND
6.5N, LITTLE CHANGE WAS NOTED. SCATTERED
S OVER THE AREA S OF A LINE FROM THE SOUTHERN
RIDA TO 2AN SU.

MIDDLE CLOUDS WERE OVER THE REMAINDER OF THE

Fig. 4. A chart received from WLO on 6.852 MHz.

column 0. After obtaining the desired row and column numbers, press the joystick button to update the display to this portion of the chart. The joystick may now be used as desired to select any further command.

LPM

This command may be used to choose which basic receiving rate (in lines per minute) is to be used. Values of 120 or 60 are possible. Most commonly heard signals will utilize a rate of 120 lpm.

QUIT

This command may be selected when it is desired to leave the Visifax program and return control to Basic. Please recall the earlier note about the incompatibility of the simultaneous keyboard and joystick port usage. When you use this command, the last chart received is maintained in a buffer in memory. (It is lost if you turn off the power!) The Utility program can print it or move it to disk. *Running any program other than Utility will destroy the chart.*

The Utility Program

Utility is required to provide several auxiliary functions, including:

- Loading the Visifax program
- Making a backup copy of the Visifax program
- Starting up Visifax
- Saving a chart to disk
- Loading a chart from disk
- Printing a hard copy of a chart from memory

It is a relatively short program that is written in Basic. The user controls its operation simply by selecting an item from a menu by pressing a single key. Utility is started by keying in the following two commands: LOAD "UTILITY",8 and RUN.

Program Visifax is loaded from disk to memory automatically when Utility first begins operation. This is required because Visifax actually assists Utility in most operations.

A backup copy of the two programs should be made on a second diskette for safekeeping (format it ahead of time). With the Utility program in memory (but not running), you may make a backup copy by issuing the command: SAVE "0:UTILITY",8. To save a backup copy of Visifax, run the Utility program and simply select the SAVE VISIFAX PROGRAM menu item.

Two menu options are available to start up Visifax—with and without clearing the received chart memory buffer.

Two menu options are available for saving a chart from memory to disk and from disk to memory. An empty diskette will have room to hold the two programs and four charts, with about 100 blocks left over for whatever you like. It will require one and one half to two minutes to save or restore a chart. A chart that has been restored to memory from disk may be viewed by starting up Visifax. (Omit the buffer clear option!)

The final menu option will print a hard copy of the memory resident chart on an attached Gemini 10X dot-matrix graphics printer (via a CARDCO G-WIZ printer interface). Since Utility is written in Basic, printing a chart is not a speedy operation. It will require 15 minutes. However, since Basic is used, this portion of the program may easily be modified for usage with similar printers. The program contains enough remarks to get you started.

Using the System

Turn your computer system on and load and run the Utility program. Select menu option 5 to start Visifax.

Fire up your receiver and then connect its audio output to the tone detector's input and the tone detector's output to joystick port 2 on the computer.

Tune in a strong facsimile signal until its characteristic screech-screech sound is of a medium pitch. Then adjust the detector's TUNE control until the tuning LED blinks in time with the audio. A moderate level of receiver audio output will be required.

Use a joystick connected to joystick port 1 to select the RESET command to begin the process of displaying a chart. Use the SYNC and RESET commands as required to properly position the chart vertically on the display. Fine-tune to get the sharpest picture.

The SCROLL command may be used at all times to scroll the received chart around the display.

To save or print a received chart, unplug the tone detector first, then select the QUIT VISIFAX command. Using the keyboard, load and run the Utility program and select the SAVE A CHART TO DISK or PRINT A CHART menu item.

Getting the Programs

For a fee of $10 to cover my expenses, I will send you a diskette containing the Visifax and Utility programs, a reprint of this information, and other various notes. Be sure to request the Commodore 64 version.

If you would like to understand better how Visifax works or how to make modifications to it, I can include printed listings of the programs and the assembler source code file for an additional $5. EDITOR64 and ASSEMBLER64 were used for program development. Note that you may modify the Utility program without this option.

I cannot accept any CODs or credit cards. The package is available from me at the address given at the beginning of this article.

A tape-based version of these programs can probably be developed. Write me if you desire a tape version (but send no money). If there is sufficient interest, I will develop it and inform you of its availability. ■

WHERE TO TUNE

By far the best facsimile signals at my location are from the Naval Eastern Oceanography Center (NAM) on 3.357, 8.080, 10.865, 16.410, and 20.225 MHz. Weather charts and satellite photographs of all types are broadcast nearly continuously.

Canadian station CFH out of Halifax, Nova Scotia, on 4.271, 6.330, 10.536, and 13.520 MHz also transmits interesting weather charts. CFH usually broadcasts one or two charts for the first 15 to 30 minutes of each hour.

Coastal station WLO broadcasts on 6.852, 9.1575, and 11.145 MHz with information that covers the entire Gulf of Mexico area. The current schedule consists of various charts starting at 0250, 0850, 1440, 1800, and 2000 UTC.

Coast Guard station NMF offers a similar service on 3.242 and 7.530 MHz that covers the northeastern coastal area. Scheduled times are 0530 and 1730 UTC.

Listed frequencies for San Francisco (I have heard a few) include 4.346, 8.682, 12.730, and 17.151 MHz. Honolulu possibly uses the frequencies 4.803, 9.440, 13.863, 16.398, and 21.785 MHz. I have copied this station only briefly.

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Frequency range: 25-550 MHz. continuous coverage and 800 MHz. to 1.3 GHz. continuous coverage.
The *Regency* MX7000 scanner lets you monitor Military, Space Satellites, Government, Railroad, Justice Department, State Department, Fish & Game, Immigration, Marine, Police and Fire Departments, Broadcast Studio Transmitter Links, Aeronautical AM band, Aero Navigation, Paramedics, Amateur Radio, plus thousands of other radio frequencies most scanners can't pick up. The *Regency* MX7000 is the perfect scanner to receive the exciting 1.2 GHz. amateur radio band.

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Bands: 30-50, 88-108, 118-136, 144-174, 440-512 MHz.
The *Regency* Z60 covers all the public service bands plus aircraft and FM music for a total of eight bands. The Z60 also features an alarm clock and priority control as well as AC/DC operation. Order today.

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The *Regency* Z45 is very similar to the Z60 model listed above however it does not have the commercial FM broadcast band. The Z45, now at a special price from Communications Electronics.

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List price $659.00/**CE price $329.95/SPECIAL**
10 Channel • 25 Watt Transceiver • Priority
The *Regency* RH250B is a ten-channel VHF land mobile transceiver designed to cover any frequency between 150 to 162 MHz. Since this radio is synthesized, no expensive crystals are needed to store up to ten frequencies without battery backup. All radios come with CTCSS tone and scanning capabilities. A monitor and night/day switch is also standard. This transceiver even has a priority function. The RH250 makes an ideal radio for any police or fire department volunteer because of its low cost and high performance. A *60 Watt* VHF 150-162 MHz. version called the **RH600B** is available for $454.95. A UHF 15 watt version of this radio called the **RU150B** is also available and covers 450-482 MHz. but the cost is $449.95.

NEW! Bearcat® 50XL-GS

List price $199.95/**CE price $114.95/SPECIAL**
10-Band, 10 Channel • Handheld scanner
Bands: 29.7-54, 136-174, 406-512 MHz.
The Uniden Bearcat 50XL is an economical, hand-held scanner with 10 channels covering ten frequency bands. It features a keyboard lock switch to prevent accidental entry and more. Also order part # **BP50** which is a rechargeable battery pack for $14.95, a plug-in wall charger, part # **AD100** for $14.95, a carrying case part # **VC001** for $14.95 and also order optional cigarette lighter cable part # **PS001** for $14.95.

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The new Fox scanner frequency directories will help you find all the action your scanner can listen to. These new listings include police, fire, ambulances & rescue squads, local government, private police agencies, hospitals, emergency medical channels, news media, forestry radio service, railroads, weather stations, radio common carriers, AT&T mobile telephone, utility companies, general mobile radio service, marine radio service, taxi cab companies, tow truck companies, trucking companies, business repeaters, business radio (simplex) federal government, funeral directors, veterinarians, buses, aircraft, space satellites, amateur radio, broadcasters and more. Fox frequency listings feature call letter cross reference as well as alphabetical listing by licensee name, police codes and signals. All Fox directories are $14.95 each plus $3.00 shipping. State of Alaska–**RL019-1**; State of Arizona–**RL025-1**; Baltimore, MD/Washington, DC–**RL024-1**; Buffalo, NY/Erie, PA–**RL009-2**; Chicago, IL–**RL014-1**; Cincinnati/Dayton, OH–**RL006-2**; Cleveland, OH–**RL017-1**; Columbus, OH–**RL003-2**; Dallas/Ft. Worth, TX–**RL013-1**; Denver/Colorado Springs, CO–**RL027-1**; Detroit, MI/Windsor, ON–**RL008-3**; Fort Wayne, IN/Lima, OH–**RL001-1**; Hawaii/Guam–**RL015-1**; Houston, TX–**RL023-1**; Indianapolis, IN–**RL022-1**; Kansas City, MO/KS–**RL011-2**; Long Island, NY–**RL026-1**; Los Angeles, CA–**RL016-1**; Louisville/Lexington, KY–**RL007-1**; Milwaukee, WI/Waukegan, IL–**RL021-1**; Minneapolis/St. Paul, MN–**RL010-2**; Nevada/E. Central CA–**RL028-1**; Oklahoma City/Lawton, OK–**RL005-2**; Orlando/Daytona Beach, FL–**RL012-1**; Pittsburgh, PA/Wheeling, WV–**RL029-1**; Rochester/Syracuse, NY–**RL020-1**; San Diego, CA–**RL018-1**; Tampa/St. Petersburg, FL–**RL004-2**; Toledo, OH–**RL002-3**. New editions are being added monthly. For an area not shown above call Fox at 800-543-7892. In Ohio call 800-621-2513.

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List price $369.95/**CE price $239.95**
11-Band, 55 Channel • Handheld/Portable Search • Lockout • Priority • Bank Select Sidelit liquid crystal display • EAROM Memory Direct Channel Access Feature • Scan delay
Bands: 29-54, 118-136, 144-174, 406-420, 440-512 MHz.
The new handheld *Regency* HX1500 scanner is fully keyboard programmable for the ultimate in versatility. You can scan up to 55 channels at the same time including the AM aircraft band. The LCD display is even sidelit for night use. Includes belt clip, flexible antenna and earphone. Operates on 8 1.2 Volt rechargeable Ni-cad batteries (not included). Be sure to order batteries and battery charger from accessory list in this ad.

Bearcat® 100XL-GS

List price $349.95/**CE price $203.95/SPECIAL**
9-Band, 16 Channel • Priority • Scan Delay Search • Limit • Hold • Lockout • AC/DC
Frequency range: 30-50, 118-174, 406-512 MHz.
The world's first no-crystal handheld scanner now has a LCD channel display with backlight for low light use and aircraft band coverage at the same low price. Size is 1⅜" x 7½" x 2⅞." The *Bearcat* 100XL has wide frequency coverage that includes all public service bands (Low, High, UHF and "T" bands), the AM aircraft band, the 2-meter and 70 cm. amateur bands, *plus* military and federal government frequencies. Wow...what a scanner!

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The Uniden 800XLT receives 40 channels in two banks. Scans 15 channels per second. Size 9¼" x 4½" x 12½."

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RD55-GS *Uniden* Visor mount Radar Detector	$98.95
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BC-WA-GS *Bearcat* Weather Alert™	$49.95
DX1000-GS *Bearcat* shortwave receiver **SALE**	$349.95
PC22-GS *Uniden* remote mount CB transceiver	$99.95
PC55-GS *Uniden* mobile mount CB transceiver	$59.95
R1060-GS *Regency* 10 channel scanner **SALE**	$92.95
MX3000-GS *Regency* 30 channel scanner	$229.95
XL156-GS *Regency* 10 channel scanner	$139.95
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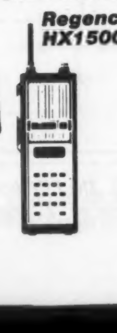

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Apartado 66994
Caracas 1061-A
Venezuela

Make the Switch to PIN Diodes

Many of us have older rigs which just can't handle QSK. Here's how to replace your relays with solid-state switches.

Number 2 on your Feedback card

It's getting very difficult to find decent replacement relays for old transceivers. Who wants to pay $45 for a relay when you know that it will need to be replaced almost as soon as you put it in? Or maybe you're just tired of cleaning the silly things. This article will show you how to replace the relay in your transceiver with a faster and more reliable solid-state switch.

Believe it or not, the easiest part of this modification is antenna switching, and it doesn't matter if you put out a milliwatt or a kilowatt. On the other hand, the circuit for dc switching requires a lot of planning and thinking—but you'll find that it is worth the time and effort it takes.

Let's Switch

Fig. 1 shows the basic configuration of a typical switching circuit used in old transceivers. The basic requirements in those days were:

1. Switch B+ from receive to transmit and back.
2. Toggle the antenna from receiver to transmitter.
3. Change the speaker from an output device to an input device, or just disable the speaker.
4. Handle any additional circuit requirement like switching bias, selective signaling, accessories, etc.

Requirement number three may sound unusual to newcomers. Speakers used to be employed as dynamic microphones when the equipment was in the transmit mode, despite their bassy sound. Some cheap (and not so cheap) intercoms use a similar procedure today.

Modern relays are rated at several million operating cycles. Unfortunately, they often fail after only several thousand cycles of operation. In heavy-duty operation, such as the dispatching of taxis, the rated specification is not applicable.

The New Approach

During the late 60s and early 70s, better and more reliable power transistors were already available for use as dc switches in the 5–10-Amp environment. Most equipment was designed for 13.8 V dc, so the power was handled very easily by these devices. Yet the most economical method of VHF/UHF antenna switching in the 2–50-Watt range was still the relay. In addition, a single or twin relay was about the same size as its transistorized equivalent, so using semiconductors saved no space.

The PIN Is Here

Vacuum-tube diodes were used for many years after solid-state devices became available (my Heath SB-100 uses a tube for avc and solid-state diodes for other functions). Then the PIN diode appeared. At first, PIN diodes were used only in VHF and UHF hand-helds, state-of-the-art (expensive) equipment, and military radios. The advantages of the PIN became evident, and it quickly became a common part of all radios, regardless of power or frequency. Despite this popularity, the behavior of the PIN is still not widely known. Let's shed some light on the subject.

First, we'll look at the characteristics of the PIN diode, then we'll see how it works, and finally we'll explain how to design a practical circuit. The characteristics are:

- It does not rectify the applied signal.
- It does not generate harmonics.
- Once forward-biased, it offers a fixed resistance path (R_S).
- Its capacitance (C_T) is constant regardless of the applied bias at VHF and above frequencies.

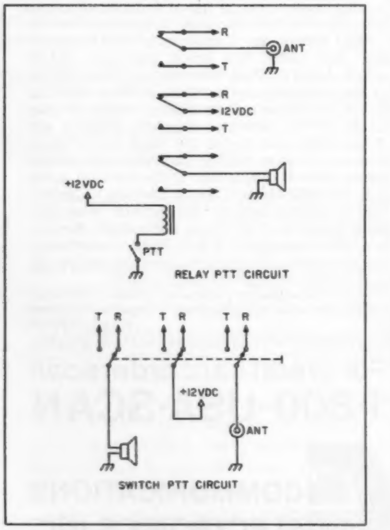


Fig. 1. This is the switching arrangement you'll find in most older transceivers.

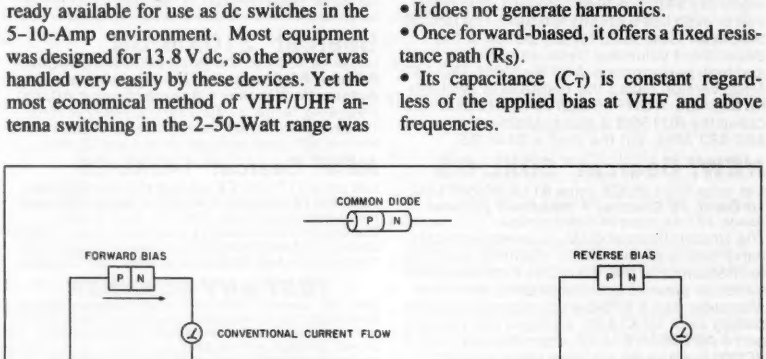


Fig. 2. The PIN diode could be called a current-controlled resistor at rf. The high-resistance intrinsic or "I" region is what sets the PIN apart from a normal silicon diode.

- It may be used from below 500 kHz up to several GHz, depending on the model.
- Its insertion loss is very low.
- It supplies a high degree of isolation.
- Its switching speed is very high.

What Is a PIN Diode?

The PIN diode is better described as a current-controlled resistor at radio and microwave frequencies. The difference between a common diode and a PIN diode is that the common diode is made of a semiconductor with P dopant in one side and N dopant in the other side (see Fig. 2). As a PN junction, the PIN is developed with the special property of easily conducting current in one direction (forward bias) while impeding current flow in the other (reverse bias). Current flows when the anode is positive and the cathode is negative. The PIN diode is made like a common diode except that a high-resistance I-region is sandwiched in between the anode and the cathode.

See Fig. 3. When the PIN diode is forward-biased, the current does not flow immediately through the I-region. It takes some time to do so. In that tiny moment, a charge is stored in the I-region, lowering its resistance to a value known as R_S. When the diode is zero-biased there is no storage charge in the I-region and the diode appears as a capacitor. This characteristic is known as C_T. The storage time is long enough so that the PIN diode cannot rectify at very high frequencies. The alternating rf current changes from plus to minus faster than the I-region allows conduction. In other words, a charged particle needs some six microseconds to travel through the I-region, which is quite a long time for any frequency period above 20 kHz.

The most common use of PIN diodes is as a switch at rf—although they are used as modulators, rf attenuators, and phase shifters up into the GHz region. Don't try to use them as detectors or to rectify an i-f signal in an agc circuit. Also, don't use them to generate harmonics from your crystal markeroscillator—it just won't work.

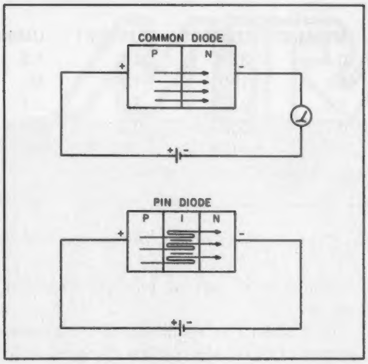


Fig. 3. The I-region is the reason a PIN diode does not rectify an rf signal.

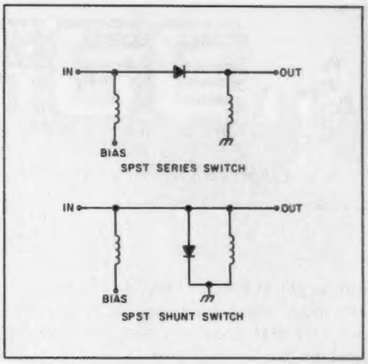


Fig. 4. These are the two basic switch configurations.

Switching Circuits Using PIN Diodes

There are two kinds of basic circuits using PIN diodes as switches. One is the series-connected single-pole, single-throw (SPST) switch and the other is the shunt-connected SPST switch. Both are shown in Fig. 4. The series-connected diode, when forward-biased, produces a very low insertion loss over a broad frequency range. Typically, the average insertion loss is around 0.1 dB. When reverse-biased, the diode impedance is very high. The average isolation is 25 dB for frequencies between 10 MHz and 2 GHz, with typical values between 15 dB and 60 dB. When shunt-connected, the PIN diode has almost the same figures for insertion loss and isolation.

The insertion loss in series-connected diodes depends on the R_S value and has a linear proportional response. The higher the R_S value, the higher the insertion loss. Typical R_S values are from 0.1 Ohms to 10 Ohms. The isolation depends on the C_T value and is also related to frequency. In this case, the higher the frequency and the higher the C_T value, the lower the isolation. C_T values are on the order of 0.2 pF to 4.0 pF.

The maximum rf power (P_A) which the PIN diode switch may handle should be calculated for a case of maximum swr or a totally mismatched antenna. It is done this way because often the transmitter is operated without an antenna or with a shorted antenna connector. For a perfectly matched antenna, the power capability of the diode is increased by a factor of four. The equation used is:

$$P_A = (12.5 \times P_D)/R_S$$

where P_D is the maximum specified dissipation of the device. 12.5 is a constant for 50-Ohm impedance systems. Note from the equation that dissipation is directly proportional to P_D and inversely proportional to R_S.

Combining Series and Shunt Values

Fig. 5 shows a combination of series and shunt connections using two PIN diodes. The circuit shows a diode (D1) series-connected with the transmitter and a diode (D2) shunt-connected at the receiver antenna input. A quarter-wave line is connected between both diodes to help in receiver isolation. During transmit, D1 conducts and transfers rf power from the transmitter to the antenna. Diode D2 is also forward-biased, shorting out the receiver antenna input. The rf current in both diodes is almost equal, even though it may not be apparent. Hence, both D1 and D2 dissipate the same power.

Fig. 6(a) shows another interesting compound switch, the TEE SPST switch. When bias is positive, diodes D1 and D2 are forward-biased, and thus both conduct rf energy from input to output. Diode D3 is reverse-biased. When bias voltage is negative, both D1 and D2 are cut off and diode D3 is conducting, resulting in almost a short to ground. This way, if any rf energy goes through D1 it will be grounded by D3; D2 will improve the attenuation. With this simple arrangement you may construct a switch that will work very well even at microwave frequencies.

Fig. 6(b) shows a practical design using this kind of switch. The importance of this switching circuit is that if you use care in construction, it is easy to achieve more than 50 dB of isolation. Actually, the isolation is much more dependent upon circuit shielding between input and output than limitations imposed by the PIN diodes. This approach is often used in instruments like signal generators and communications monitors.

Designing the Solid-State Rf Relay

To illustrate how all of this information

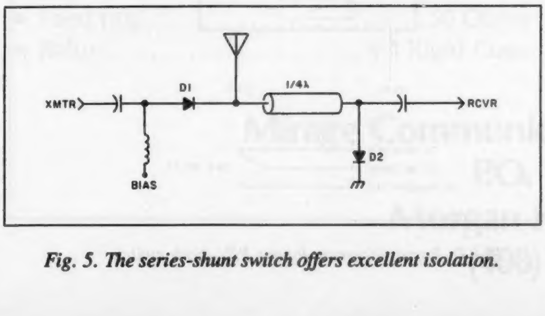


Fig. 5. The series-shunt switch offers excellent isolation.

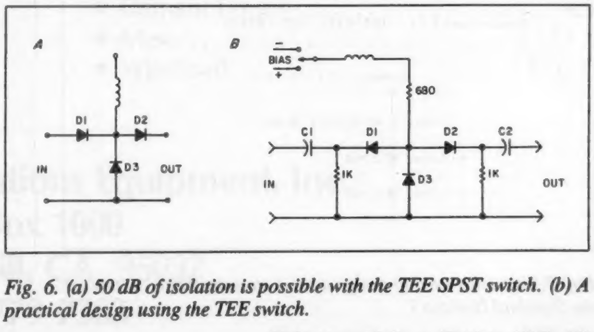


Fig. 6. (a) 50 dB of isolation is possible with the TEE SPST switch. (b) A practical design using the TEE switch.

	ECG553	ECG555	MI301	MPN3401	UM4901	UM4001	UM9401	1N5767	
P_D	0.2	0.4	0.35	0.4	37.5	2.5	1.5	0.4	Watts @25°
$V(B_R)$	30	35	80	35	100	100	50	100	Volts (piv)
C_T	2.0	1.0	3.0	1.0	3.0	3.0	1.1	0.4	pF@100 volts, 1 MHz
R_S	1.2	0.7	2.0	0.7	0.25	0.5	0.4	1.5	Ohms @100 mA, 100 MHz
P_A	2	7	2	7	2 kW	62	47	3.3	Watts @ maximum swr

Note: All specs are for axial-lead packages except the UM4901, which is a stud mount.

Table 1. Characteristics of several common PIN diodes.

can be put to practical use, I will design a PIN diode switch to replace the relay in the old VHF FM amateur radio, the Standard Horizon 2.

I began my design by gathering and comparing specifications. Table 1 shows the most important specs of several diodes. P_D stands for the diode's dissipation power. $V(B_R)$ is the maximum permissible voltage allowed by the device. C_T is the capacitance at the specified frequency and applied voltage. R_S is the resistance at the specified current bias and operating frequency. P_A is the maximum amount of power the diode can handle as a switch at maximum swr. From Table 1, I chose the most suitable device for the Horizon 2, using $P_A = (12.5 \times P_D)/R_S$ to determine the maximum power each device could handle.

The Horizon 2 is rated at 25 Watts output; a UM9401 is more than adequate for the job since it is capable of managing some 25 Watts at 50 mA of forward bias at a high swr.

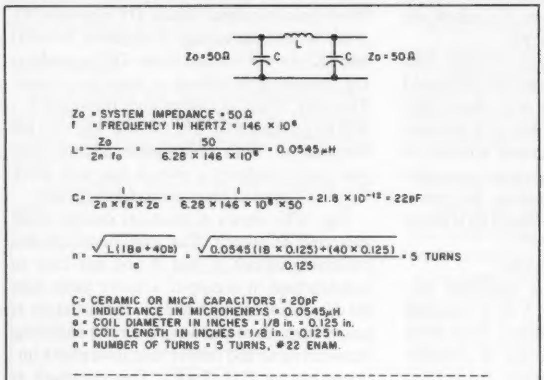
The UM9401 is smaller than a common silicon rectifier diode, but don't judge it on its size! Despite being just 2.29mm in diameter, it can handle more than 100 Watts of rf when properly installed. The UM9415, which is 3.30mm in diameter, can carry more than 1 kW when forward-biased at 1 Ampere and properly installed.

The UM4901 is capable of handling 10 kW of rf CW power or 100 kW of peak pulse power if the antenna is perfectly matched—yet it is not larger than a 10-Watt stud-mounted zener. Several diodes are rated at 1,000 volts or higher.

The most suitable circuit for our application, which is also widely used in modern radios, is the combination of the series and shunt switch, shown in Fig. 5.

First, I replaced the quarter-wave line with an equivalent lumped circuit using components selected from the formulas in Fig. 7. The values computed for the center of the 2-meter band (146 MHz) are 0.0545 uH for L and 21.8 pF for C. Since the circuit capacitance will be part of the circuit, I chose 20 pF for C. The additional capacitance is supplied by the stray wiring capacitances and the C_T capacitance of the diode. The coil is made by winding five turns of enameled #22 wire. Some trial and error may be necessary in this regard, but the recommended values should work in any 2-meter radio.

The bias resistor is calculated using Ohm's Law (see Fig. 7). Assuming a power supply of 12.6 V dc and 50 mA of bias current, the resultant resistance value is 237 Ohms. A resistor of 220 Ohms at 1 Watt is close to the calculated value which, by the way, is not critical at all. For a radio of less power (say 10 Watts) you may use a 270-Ohm @ 1-Watt resistor and the resulting bias current (0.050 A) will be enough. All modern radios use



Zo = SYSTEM IMPEDANCE = 50Ω
f = FREQUENCY IN HERTZ = 146 × 10⁶

$$L = \frac{Zo}{2\pi\, fo} = \frac{50}{6.28 \times 146 \times 10^6} = 0.0545\,\mu H$$

$$C = \frac{1}{2\pi \times fo \times Zo} = \frac{1}{6.28 \times 146 \times 10^6 \times 50} = 21.8 \times 10^{-12} = 22pF$$

$$n = \frac{\sqrt{L(18a + 40b)}}{a} = \frac{\sqrt{0.0545(18 \times 0.125) + (40 \times 0.125)}}{0.125} = 5 \text{ TURNS}$$

C = CERAMIC OR MICA CAPACITORS = 20pF
L = INDUCTANCE IN MICROHENRYS = 0.0545μH
a = COIL DIAMETER IN INCHES = 1/8 in. = 0.125 in.
b = COIL LENGTH IN INCHES = 1/8 in. = 0.125 in.
n = NUMBER OF TURNS = 5 TURNS, #22 ENAM.

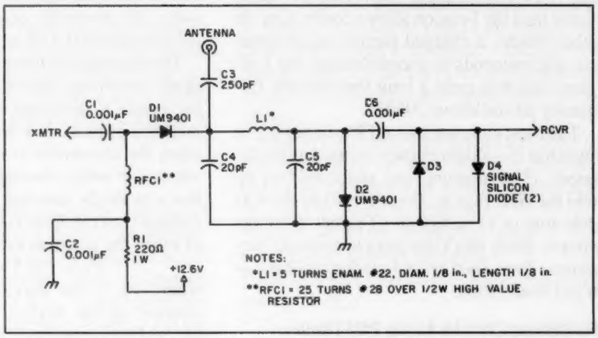
COIL DIAMETER = 1/8 in.
b = 1/8 in. 5 TURNS NO. 22 B&S

$$E_{EACH\ DIODE} = I \times R = 0.05 \times 0.75 = 0.0375V$$

$$RI = \frac{E - (2 \times 0.0375)}{I} = \frac{12.6 - 0.75}{0.05} = 237\Omega$$

$$RI_{DISSIPATION} = E \times I = (12.6 - 0.75) \times 0.05 = 0.592\,W$$

Fig. 7. Formulas used to design a solid-state switching system for the Standard Horizon 2.



NOTES:
*L1 = 5 TURNS ENAM. #22, DIAM. 1/8 in., LENGTH 1/8 in.
**RFC1 = 25 TURNS #28 OVER 1/2W HIGH VALUE RESISTOR

Fig. 8. The Horizon 2's new PIN-diode switch.

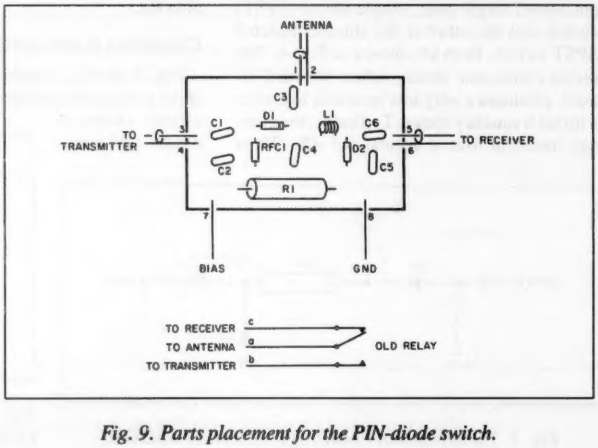
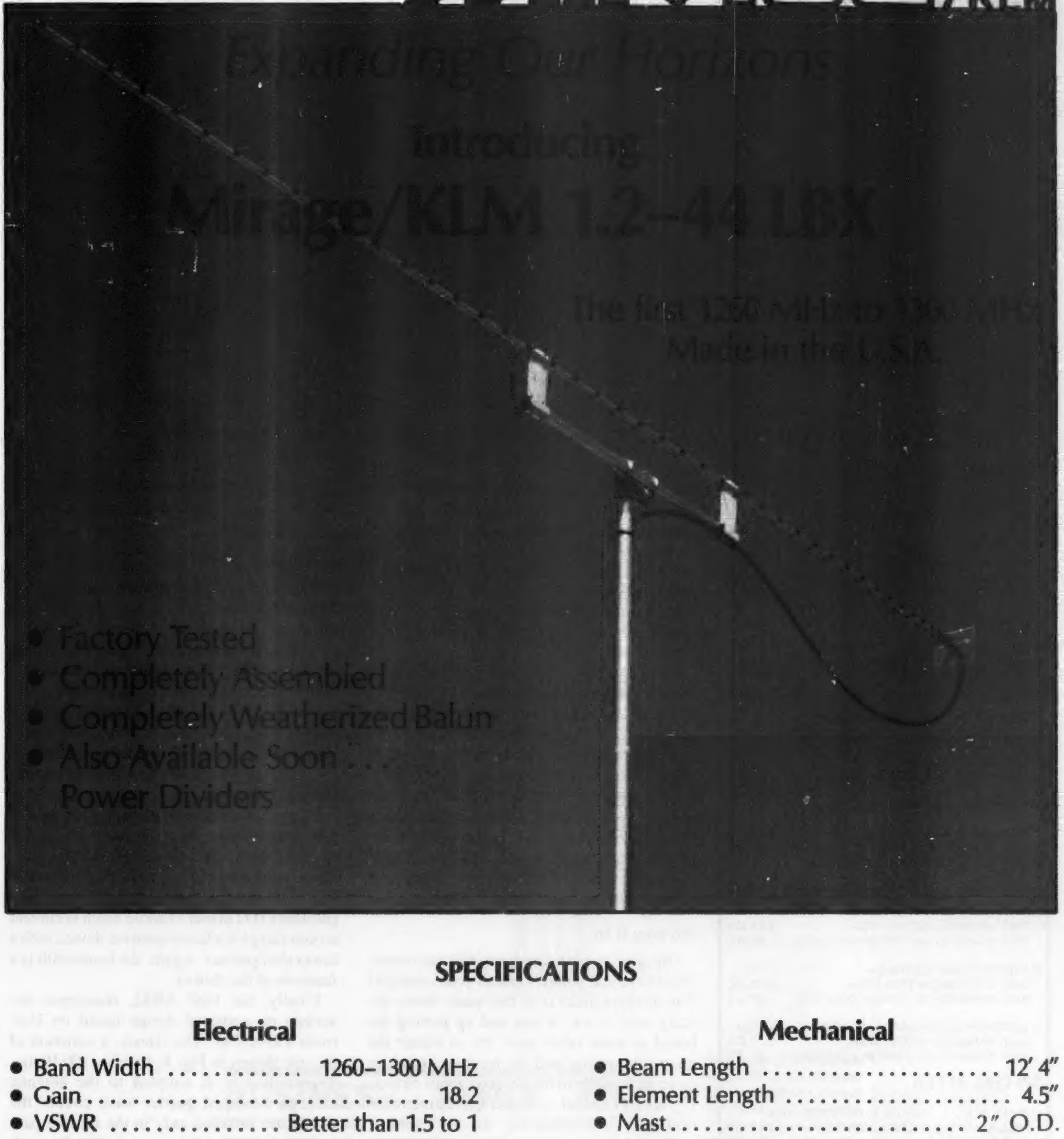


Fig. 9. Parts placement for the PIN-diode switch.



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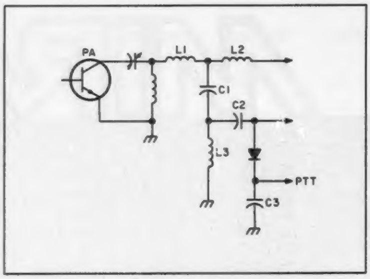

Fig. 10. Motorola used this clever circuit in their Maxar VHF radio.

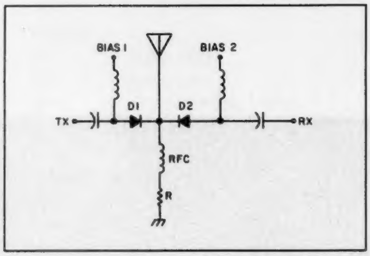

Fig. 11. PIN diodes can be used with good success at HF. . . try this circuit, taken from a Unitrode handbook.

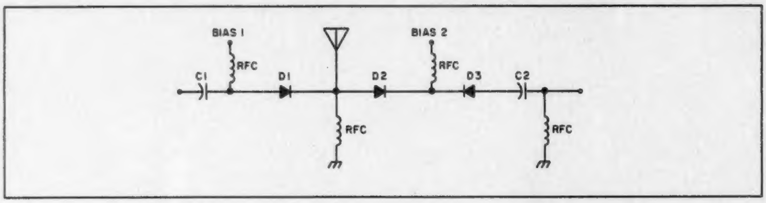

Fig. 12. This circuit will switch up to a kilowatt of rf.

standard 10% resistors installed for this purpose. Should your power be higher (say 35 Watts), use a 150-Ohm at 1-Watt resistor. Remember that the calculation is for an swr of infinity, and if the antenna is perfectly matched the allowable power is quadrupled. This means that, in a transmitter with swr protection, the PIN may be operated with a lower forward bias.

The choke is wound on a high-value half-Watt resistor—put as many turns of enameled #28 wire as you can in one layer. You should shoot for 2.7 uH for VHF or 1.2 uH for UHF.

The completed circuit is shown in Fig. 8. C1 and C6 act as blocking capacitors, while C2 decouples the diode bias line. D1 is the series switch on the transmit side, and D2 is the receiver shunt. C4, L1, and C5 form the quarter-wave section. D3 and D4 provide protection for the receiver input; they clip signals that rise above about 0.6 volts.

Sticking It In

OK, you've got everything built and tested. Where are you going to install your creation? The obvious place is in the space where the relay used to sit. If you end up putting the board in some other spot, try to situate the quarter-wave line and the receiver switch as close as possible to the receiver input circuit. If you can't do that, use coax for the interconnection.

The El-Cheapo Approach

Motorola used a very interesting circuit in their old Maxar VHF radio (Fig. 10). C1, C2, and L3 form a quarter-wave line which is grounded by PIN D1 during transmit—this places C2 at ground potential and C1 at a high impedance. During receive, D1 is cut off and the rf passes through the quarter-wave line. This approach may not work unless your PA is the same as the one shown—note that there is no pi network on the output. I couldn't use this configuration on the Standard since the low-impedance path during receive goes to the wrong place.

PIN Diodes at HF

Even though PIN diodes are essentially microwave devices, they can be used at HF with good success. Unitrode's *PIN Diode Designer's Handbook* suggests using the circuit shown in Fig. 11. This design uses two diodes and two bias voltages. Forward bias is applied to D1 or D2, depending on whether you're transmitting or receiving. The upper frequency is determined by the capacitance of D2, and the bandwidth is a function of the chokes.

Fig. 12 shows another approach to HF switching, again by Unitrode. Using the diodes shown, the circuit will safely handle up to a kilowatt of rf. D1 should be selected for its power dissipation, and D2 for its capacitance (D2 doesn't handle much rf current so you can pick a less expensive device with a lower dissipation). Again, the bandwidth is a function of the chokes.

Finally, the 1985 ARRL *Handbook* describes an outboard design based on Unitrode's UM5767. The circuit, a variation of the one shown in Fig. 8, handles 100 Watts. Transmitted rf is coupled to the antenna through a lumped quarter-wave circuit; the diodes are installed only in the receive path (which means that they need not handle much rf). This could be the perfect compromise for your old SSB transceiver, and might even be cheaper than replacing a relay.

In Closing

The modification I've described for a VHF radio is very simple, and you should have no trouble adapting it to just about any unit. If you get really stuck, send me an SAE, a handful of IRCs, and a complete description of the radio you're trying to modify. ■

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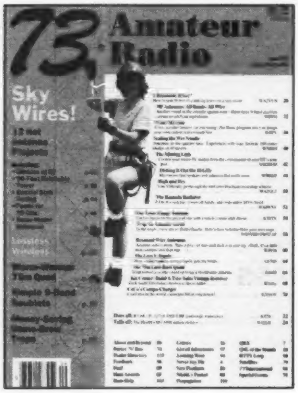

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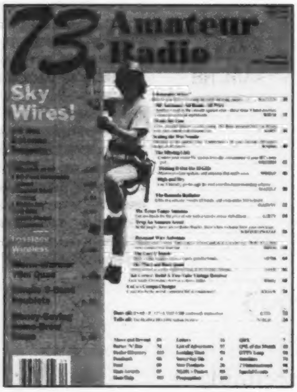

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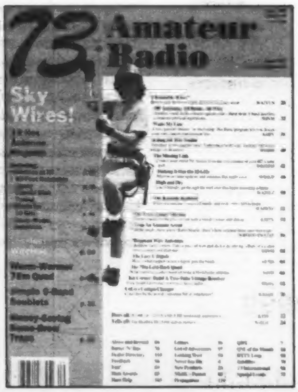

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Shoestring Shortwave

Turn a handful of parts and a piece of wood into a two-transistor shortwave converter.

Number 3 on your Feedback card

Here is a basic shortwave converter that uses only two low-cost transistors and two D cells for power, and is designed for low overall cost with no sacrifice of sensitivity or selectivity. The circuit converts frequencies from 6 to 21 MHz to the AM broadcast band. No wires or connections of any kind to the AM set are needed—a ferrite-core coil positioned near the loopstick of the AM set will do the trick. The AM set supplies the sensitivity, selectivity, avc, audio, and loudspeaker for good reception of shortwave stations from around the world.

The converter is wired point-to-point and thus is easily maintained, repaired, and modified. It's simple to just add on sections for different modes, such as CW, SSB, FM; for microwaves; and for special frequencies as desired. Modules plug together with phono jacks, so the radio can be reconfigured in a matter of minutes.

Front panels are of double copperclad phenolic—my long-time favorite because the thin copper solders with the touch of a small iron, and the phenolic is very strong for front panels, boxes, shield walls, sub-panels, etc. The main base is wood; each module is fastened down with one large screw for easy servicing, modifications, add-ons, and other changes you might want to make later (see Fig. 1).

Construction

The first module is the preselector, shown in Fig. 2. L1 is wound on a high-Q ferrite core, which cuts down image response and increases selectivity. The circuit is tuned to the desired frequency by C1, a 365-pF maximum capacitor. No vernier is needed, as the tuning is not that critical. The shielded output cable to the mixer module is coupled to L1 via L2 (two turns of wire around the ground end of L1).

Oscillator Circuit

The oscillator module requires more care in its construction, testing, and tuneup, but expect no trouble if you follow instructions carefully. Look at Fig. 3. L10 and C10 determine the frequency in the 6–21-MHz range. The emitter of Q1 is tapped up one turn from the ground end of L10 through C12, which produces feedback to Q1 and causes oscillation. (When measuring voltage in this circuit, always take care to differentiate between the dc and the rf voltages. The collector has the full 3 volts on it from the battery supply, as well as the maximum rf voltage. The base has 1.2 volts dc on it when operating but is grounded for rf by C11; thus it has no rf voltage on it, measured to ground. The emitter has 1 volt dc on it, measured to ground, and also a small amount of rf.)

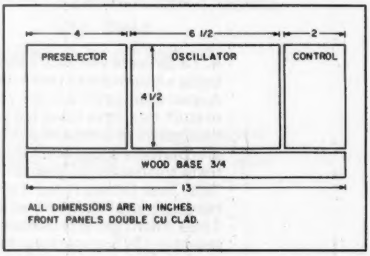
4
6 1/2
2
PRESELECTOR
OSCILLATOR
CONTROL
4 1/2
WOOD BASE 3/4
13
ALL DIMENSIONS ARE IN INCHES.
FRONT PANELS DOUBLE CU CLAD.

Fig. 1. Front view of the converter. Modules are mounted on a piece of 3/4" wood.

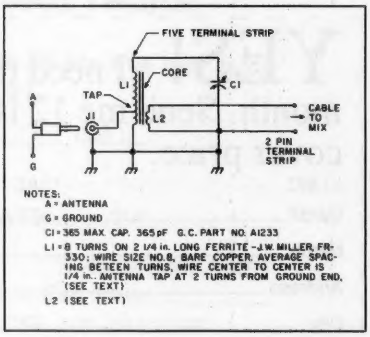
FIVE TERMINAL STRIP
CORE
L1
C1
TAP
A
J1
L2
CABLE TO MIX
2 PIN TERMINAL STRIP
G
NOTES:
A = ANTENNA
G = GROUND
C1 = 365 MAX. CAP. 365 pF G.C. PART NO. A1233
L1 = 8 TURNS ON 2 1/4 in. LONG FERRITE - J.W. MILLER FR-330; WIRE SIZE NO. 8, BARE COPPER. AVERAGE SPACING BETEEN TURNS, WIRE CENTER TO CENTER IS 1/4 in.. ANTENNA TAP AT 2 TURNS FROM GROUND END, (SEE TEXT)
L2 (SEE TEXT)

Fig. 2. Preselector schematic.

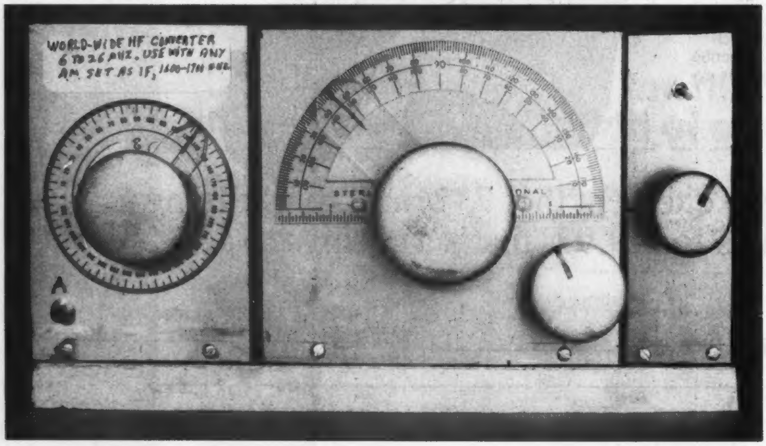
WORLD-WIDE HF CONVERTER
6 TO 26 MHZ. USE WITH ANY
AM SET AS IF, 1600-1700
A

Photo A. A spruced-up front panel for the prototype converter on the cover of the magazine. Two protractors are installed for ease of logging.

The rf generated by Q1 through its feedback circuit and present on L10 is coupled to L11, a single loop, and sent via the oscillator cable (which may be twisted-pair or shielded cable—not critical) to J21 of the mixer module. The position of the emitter tap on L10 controls the amount of oscillation, and may be adjusted as follows—this *is* critical. Move the tap a little closer to ground (perhaps three-quarters of a turn from ground) to *reduce* oscillation and perhaps one and one-quarter turns *away* from ground to increase oscillation. Too much feedback will show up as a lot of loud noise when the set is operating.

L11 does not need to be over L10. Best results are had by placing L11 over the ferrite core only, spaced about one-eighth to one-quarter inch from the low-voltage end of L10. (This is the end of L10 that is bypassed to ground by C14 and also is the +3-volt connection.)

In order to place the low-frequency end of the range (6 MHz) near but not at the end of the dial, add or subtract slightly from the high end of L10. This is where the collector and C10 are connected. You will find few BC stations lower than 6 MHz.

Mixer Circuit

The circuit in Fig. 4 has been designed to offer good sensitivity, low noise, and considerable gain. The base of Q2 receives the tuned rf signal from the preselector through C22. The emitter receives the rf oscillator voltage through C21. The dc voltage on the mixer base is +.6 to +.8 volts, and on the emitter it is +.4 volts. The collector has the full battery supply of 3 volts on it. There are no tuned circuits in the mixer module itself, but the collector output is tuned in the control module by C31 and the mixer output coil, L40, which couples the mixer to the AM set.

A small copperclad wall is used to shield the input circuit of the mixer from the output. This is not critical as the frequencies are different, being separated by 1,600 kHz.

Control Module

The output from the mixer goes over a low-capacity cable to the control module where C31 tunes the mixer collector output, the cable, and the AM pickup coil to the frequency to which the AM set is tuned (see Fig. 5). The control module also contains the on/off switch for the 3-volt battery supply to the oscillator and mixer transistors, Q1 and Q2. The AM output coil, L40 (see Fig. 6), is tuned by C31 to an i-f of around 1,600 kHz. There generally is a more or less quiet spot to be found there, although occasionally between 1,800 and 1,600 kHz you may hear a neighbor telephoning a friend! The mixer output is very strong, however, and will swamp out all but a very loud local signal. If you run into trouble, just bump the i-f a little.

Note that there are a number of items in this chain, each contributing to the total capacitance, so do not be surprised at the relatively small number of turns (low inductance) in output coil L40. It works!

L40 is what you use to control sensitivity and selectivity. If you're trying to pick up

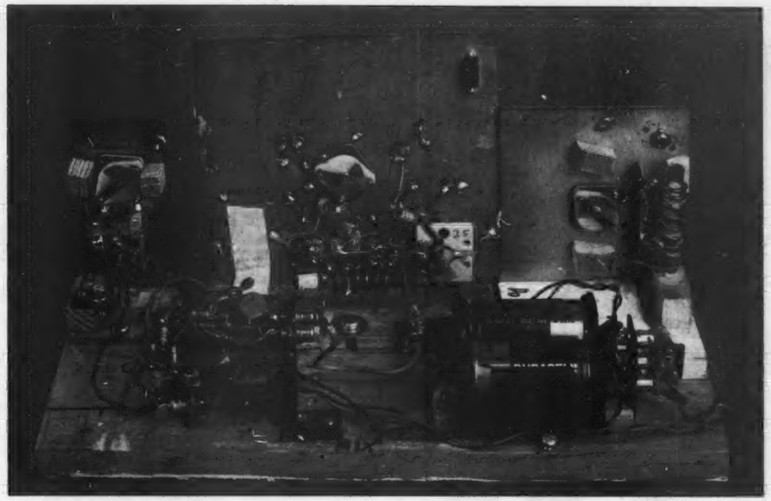

Photo B. Interior view of the prototype.

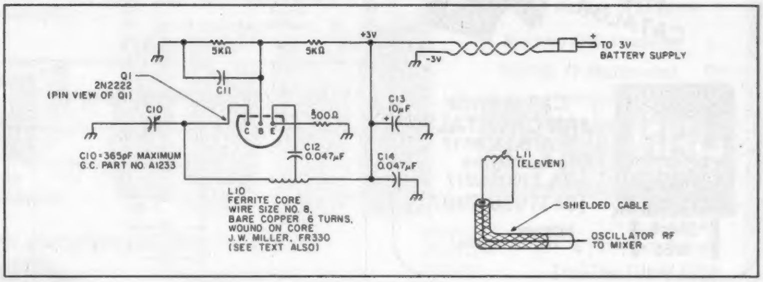
+3V
5KΩ
5KΩ
+
TO 3V
BATTERY SUPPLY
-3V
Q1
2N2222
(PIN VIEW OF Q1)
C11
C10
C B E
500Ω
C13
10µF
+
C10=365pF MAXIMUM
G.C. PART NO. A1233
C12
0.047µF
C14
0.047µF
L11
(ELEVEN)
L10
FERRITE CORE
WIRE SIZE NO. 8,
BARE COPPER 6 TURNS,
WOUND ON CORE
J.W. MILLER, FR330
(SEE TEXT ALSO)
SHIELDED CABLE
OSCILLATOR RF
TO MIXER

Fig. 3. Oscillator schematic.

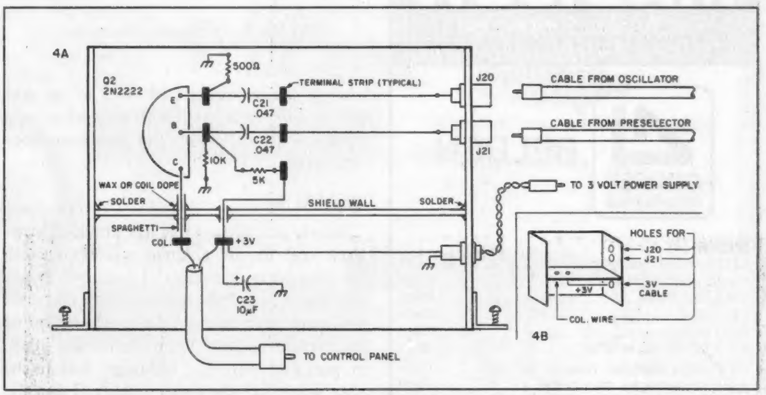
4A
500Ω
Q2
2N2222
TERMINAL STRIP (TYPICAL)
J20
CABLE FROM OSCILLATOR
E
C21
.047
B
C22
.047
CABLE FROM PRESELECTOR
J21
C
10K
5K
WAX OR COIL DOPE
TO 3 VOLT POWER SUPPLY
SOLDER
SHIELD WALL
SOLDER
SPAGHETTI
COL.
+3V
HOLES FOR
J20
J21
+3V
3V
CABLE
C23
10µF
COL. WIRE
4B
TO CONTROL PANEL

Fig. 4. (a) Pictorial schematic of mixer; (b)mixer shield box.

KITS AVAILABLE

The shortwave converter described in this article is available as both a kit and an assembled unit. The version for sale looks a bit fancier than the one pictured on the cover (we wanted to get your attention). Send $49 for the kit or $69 for the assembled version (postpaid) to Conelec Corp., Box 538, Peterborough NH 03458, Attn: Kit Sales.

Three add-ons will be available for the shortwave converter not too long from now; they have been designed and tested and work well. They do not require any internal changes in the converter described here. They are: a bfo for reception of CW and SSB; a low-noise rf stage for improved reception and better image rejection; and a simple detector for the 5–21-MHz range that lets you check the frequency of your oscillator.

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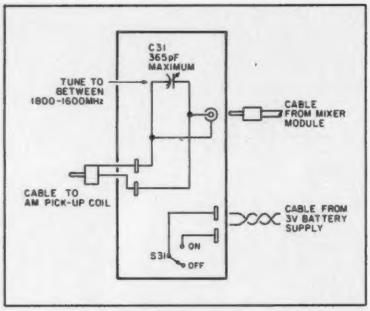
C31
365pF
MAXIMUM
TUNE TO BETWEEN 1800-1600MHz
CABLE FROM MIXER MODULE
CABLE TO AM PICK-UP COIL
CABLE FROM 3V BATTERY SUPPLY
ON
S31
OFF

Fig. 5. Back view of the control module.

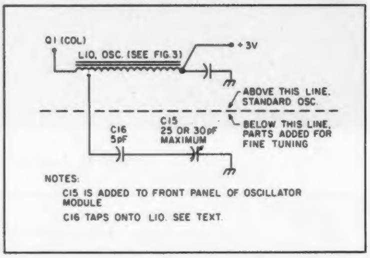
Q1 (COL)
L10, OSC. (SEE FIG.3)
+3V
ABOVE THIS LINE, STANDARD OSC.
BELOW THIS LINE, PARTS ADDED FOR FINE TUNING
C16
5pF
C15
25 OR 30pF
MAXIMUM
NOTES:
C15 IS ADDED TO FRONT PANEL OF OSCILLATOR MODULE
C16 TAPS ONTO L10. SEE TEXT.

Fig. 7. Optional fine-tuning system.

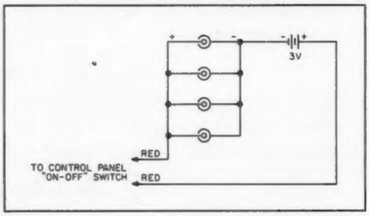
+
-
3V
RED
TO CONTROL PANEL "ON-OFF" SWITCH
RED

Fig. 9. Power supply schematic.

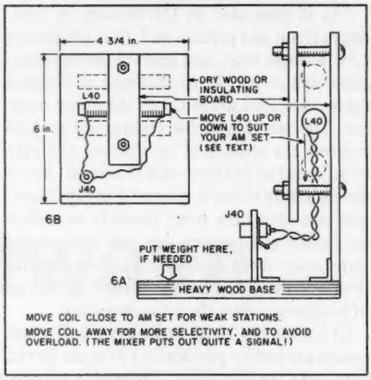
4 3/4 in.
6 in.
L40
J40
DRY WOOD OR INSULATING BOARD
MOVE L40 UP OR DOWN TO SUIT YOUR AM SET (SEE TEXT)
L40
6B
J40
PUT WEIGHT HERE, IF NEEDED
6A
HEAVY WOOD BASE
MOVE COIL CLOSE TO AM SET FOR WEAK STATIONS.
MOVE COIL AWAY FOR MORE SELECTIVITY, AND TO AVOID OVERLOAD. (THE MIXER PUTS OUT QUITE A SIGNAL!)

Fig. 6. (a) AM set pickup coil; (b) back view.

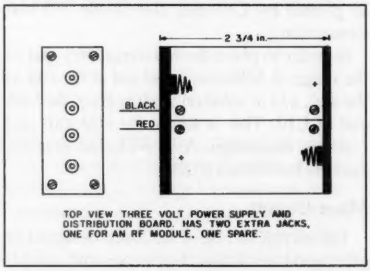
2 3/4 in.
BLACK
RED
+
+
TOP VIEW THREE VOLT POWER SUPPLY AND DISTRIBUTION BOARD. HAS TWO EXTRA JACKS, ONE FOR AN RF MODULE, ONE SPARE.

Fig. 8. Top view, 3-volt power supply and distribution board.

a weak station, bring L40 close to the AM set. Moving L40 away from the AM set will decrease the coupling, and give you more selectivity.

The AM Set

Nearly any AM set that has a built-in loopstick coil for its antenna will work with the shortwave converter. I have yet to see one that is in at least fair condition that does not work well as the i-f and af portion of the overall receiver. Even a ten-dollar pocket portable will do, although you probably won't like the music quality (I don't!). The AM set furnishes good sensitivity as an i-f as well as good selectivity, good agc, and, if the AM set is of good quality, fair fidelity.

Operation

The first thing to do is set up the AM radio. Turn on the AM set and tune it to a quiet spot between 1,600 and 1,700 kHz. Place the output coil of the converter (L40) near the AM set. Now switch on the converter and twiddle C31 until you hear noise in the AM radio. You shouldn't have to adjust this again.

Attach an antenna—the length could be 10 or 15 feet indoors, but 50 feet outdoors is better; 100 feet is fantastic! Stretch out the wire on the floor, tape or tack it near the ceiling, or tie a string to it and throw it outside over a bush or tree. Good shortwave antenna kits are also available, of course.

Tune C10 slowly, especially at the high end of the frequency range, to find the station you're looking for. If you are a bit heavy-handed, you might want to try the optional fine-tuning system shown in Fig. 7—use a giant knob to increase the bandspread even more. If you use this optional circuit, move the tap connecting C16 to L10 in order to adjust the amount of fine-tuning you want. I found that two turns from the high end of L10 suited my needs. Keep the wire of C16 no more than half an inch in length. Set C15 in the middle of its range and tune C10 to the general area you want. C15 will then tune over several stations on each side.

A good way to keep track of your activities is to use stick-on labels. When you hear a station, just fasten a sticker right to the dial. You can also use an inexpensive protractor as a logging dial—fasten it directly on the face of the converter.

One of the important features of this converter is its availability for instant use in case of emergency—so it is dry-cell battery powered. The two transistors, Q1 and Q2, use very little current: 3.5 mA total. The system is therefore quite economical. Use two heavy-duty D cells for maximum stability. At least one good portable AM set should be on hand for this emergency use. ■

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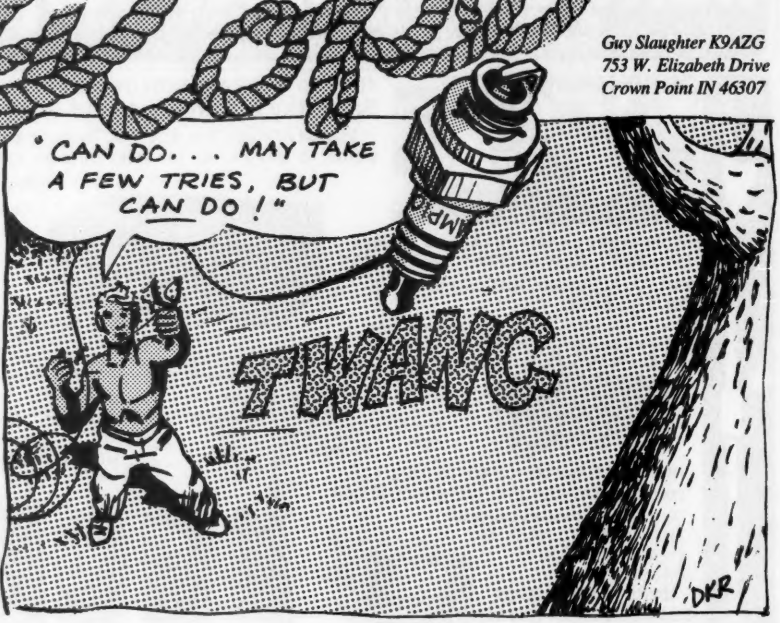
"CAN DO. . . MAY TAKE A FEW TRIES, BUT CAN DO!"
TWANG
DKR

Number 4 on your Feedback card

I have just given up a skill it took me years to perfect, swearing never again to help a fellow ham hang an antenna among his trees. It isn't that I don't like to be a nice guy. It's just that I can't afford being sued. Besides, my wife says she'll set fire to my shack if she catches me playing the Good Samaritan of the Skywires again.

See, I got myself in trouble the last time I did my thing, thus proving that nothing is foolproof, not even my Indiana Rope Trick.

You've probably heard of the Indian Rope Trick, where a fakir in a turban flutes a snake out of a basket, turns it into a rope, and levitates it up into the air so his stooge can climb it. Big deal. The act winds up with this rope standing there, an Indian kid atop it, of no use to anyone.

My version is infinitely superior. I levitate a rope into the top of a tall tree without a snaker or a faker, nobody has to climb it, and it supports an antenna wire up there above the housetops where it can radiate as much rf as you want to feed it.

I don't use magic, as the Indian practitioners claim to do, or mass hypnosis, as their detractors contend they actually do. My system is earthy, pragmatic, and simple, and is based solely on skill and marksmanship. I had been practicing it for years without a problem, until just a couple of months ago.

That's when the doorbell rang at my house, repeatedly, insistently, as I ran up the stairs from my basement shack to answer it. I found an agitated young man on my front stoop, jumping up and down in apparent excitement. He was wearing a T-shirt, jeans, a baseball cap, and sneakers.

"I was driving by," he said breathlessly when I opened the door. He jerked his thumb at an angle upwards, toward the trees in my backyard. "You the guy owns that antenna?"

"Yes," I said, craning my neck to see if the wire had come down. "What's wrong with it?"

"Nothin's wrong with it. That sucker's up 50, 60 feet, hangin' in them trees!"

"Closer to 70," I said, wondering if I was supposed to have a city permit for so high a wire, or maybe a red flasher light to warn airplanes away. "It's been up there more'n a year."

"But them're locust trees. Nobody can climb to the tips of locust trees."

"I know."

"You got a lot of wire up there."

"About 270 feet," I said. "It's a full-wave loop on 80 meters. So?"

"So how'd you get it up there?"

"Ropes," I said. "Four of 'em. One in each corner. It ain't quite a perfect diamond on account of the uneven tree spacing. And it ain't quite horizontal either, because the trees are different heights. But it's close. What's your name?"

"Charley," the young man said. "I know, ropes. Of course, ropes. But how'd you get them ropes up over them treetops?"

"Oh," I said, understanding. "Shot 'em up there. My name's Guy. You a ham, Charley?"

"Yeah," he said, looking disappointed. "A ham with tall trees like you got there that nobody can climb. But I've tried that shootin' system, and it don't work. The branches're too thick. The arrows get caught in 'em."

"Can't use arrows in locusts," I said. "Nor in other snaggle-branched trees, either." I stepped back out of the doorway. "Come on in. How about some coffee?"

"If not a bow and arrow, whadya use?" Charley demanded, stepping inside, "a harpoon gun?"

"A slingshot," I said, leading him into the kitchen and waving him onto a chair. "One of those commercial slingshots powered by surgical-rubber tubing on a steel fork. Cream and sugar?"

"Black," he said, watching me pour coffee into a couple of cups. "I don't think a slingshot'll work at my place. My trees're awful thick and snaggy."

"It'll work," I told him. "Guaranteed. It's all in the projectiles. I use old spark plugs. They're ideal. Good and heavy, easy to tie to, perfect shape to penetrate tree limbs and fall back through snaggy branches."

"You tie a string to the plug, then use the string to haul a rope up?"

"Not string. I use a spinning rod with an open-faced reel carrying about a 10-pound test monofilament. That weight's light enough to shoot and strong enough to pull a polypropylene cord up with. The cord then can haul a rope up. Be happy to demonstrate it for you."

"At my house?" Charley asked, apparently enthralled at the prospect.

"Where else?" I said.

"For how much?"

"For free. I only do the Indiana Rope Trick as an amateur. Drink up and I'll show you my shack."

That was on a Wednesday. I was a little bit late arriving at his place the following Saturday morning because I got lost trying to find it. He was waiting in the front yard by the curb, pacing back and forth when I drove up. He looked relieved. Beyond his house I could see a half dozen tall trees extending well above the roof line and waving in the wind.

"I thought maybe you weren't coming," he said as I climbed out of the car. "Too windy or something."

"Took a wrong turn," I said, handing him the spinning rod. "Little wind won't bother. Hang onto that for me."

He took the rod, and I followed him around the house, through a gate and into his chain-link fenced backyard. "So where do you want the skyhook ropes?"

Charley pointed to two trees in opposite corners of the yard. There was a dipole strung between them, low, maybe 25 feet off the ground.

"There and there. I want to hang a delta loop cut for 40 between those two locusts. I'll feed it from the apex at the bottom."

"So you need to tie off the top corners at least 50 feet up," I said, eyeing the target trees. One was close to 70 feet tall, the other maybe 10 feet shorter.

"Can do?" Charley asked.

"Can do," I said. "May take a few tries, but can do."

A little crowd had gathered to watch us. There were three kids, a dog, and a mean-looking woman I took to be Charley's wife standing in the yard. He didn't introduce us.

"Watch closely," I told the audience, tying a loop in the end of the monofilament spinning line and encircling the spark plug above the threads between the gasket washer and the porcelain. "Nothing up my sleeves." I leaned the rod against the fence, unlatched the reel, centered the spark plug in the leather pouch of the slingshot, aimed just above the top of the taller tree, and fired. The projectile arched through space, trailing its almost invisible tether line, started earthward well beyond the treetop, dropping the monofilament into the highest branches. I laid down the slingshot, picked up the spinning rod, and latched the reel.

"First shot looks good," I said. "You want to go find the spark plug, unfasten it, and tie your pilot cord to the fishing line? Then I'll start reeling it in."

"Right," Charley yelled. He galloped off, disappeared behind the target tree. I began reeling gently, feeling the line slip through the branches, stopped when the weight of the spark plug tugged at the rod tip.

Suddenly there came a caterwaul from behind the target tree—shrill, loud, ear-piercing screams of a human being in physical agony.

I dropped the rod and took off for the noise on the dead run, vaguely aware that I was being followed.

I found Charley trying to shake off a squirrel that appeared to be firmly attached to his hand.

"Ayyyyyy, get it off," he was screaming, swinging his encumbered hand back and forth at arm's length and bludgeoning at it with the other hand. "Ayyyyyy, get it off!"

I made a stab at the squirrel as it swung past me on the end of Charley's arm like the knob on the end of a pendulum, missed, tried again as it swung by on the return cycle, hit warm and yielding fur, saw the animal drop off and streak away across the grass.

My recollection of the next few seconds is blurred and comes in bursts—frozen-action scenes from a slow-motion movie, a series of time-lapse, strobe-stopped snapshots with sound. Charley, his hand spouting little geysers of blood from a dozen perforations, was prancing about under the tree, continuing to scream, waving his arm back and forth as if flagging down a train. The mean-looking woman I took to be his wife came pounding up behind me, began to beat me about the head with her fists, and joined in the screaming. The squirrel scampered up the tree trunk and disappeared into the lower branches. The spark plug I had but lately fired into space hung waist high off the ground, swinging slowly from an invisible tether.

I left it swinging and departed, hurriedly, not stopping for either my spinning rod or my slingshot, the screaming still ringing in my ears, the blows still falling about my head until I managed to outrun the mean-looking woman, maybe halfway to my car.

The blurred details of the incident later were clarified somewhat by a summons inviting me to appear in court as defendant in a civil suit seeking $5,000 for medical expenses, for pain and suffering and for loss of income sustained by the plaintiff while recuperating from multiple squirrel bites.

The bites, the complaint said, were suffered by the party of the first part when he picked up from the ground and comforted an unconscious squirrel that had fallen from a tree. The animal panicked when it recovered consciousness to find itself a captive, the complaint theorized, and ran toothily amok to bite repeatedly the hand that fondled it.

"Ayyyyyy, get it off," he was screaming, swinging his encumbered hand back and forth at arm's length and bludgeoning at it with the other hand. "Ayyyyyy, get it off!"

The hapless beast was blameless, the complaint further alleged, an innocent third party that had been minding its own business in its own nest atop a tree owned and controlled by the party of the first part, the plaintiff-victim, when the defendant-villain, party of the second part, precipitated the unfortunate incident by shooting the defenseless creature out of its home with a steel and porcelain projectile fired from a hunting-type slingshot, causing it to fall to the ground below. It was the impact of the projectile against the squirrel that produced its stunned and unconscious condition, the arousal from which led to the plaintiff-victim's injuries, the complaint said, which were the final link in a chain of circumstances clearly forged by the defendant-villain, me.

The outcome could have been worse.

My lawyer settled the case out of court, happily forestalling a possible criminal prosecution for unlawful squirrel hunting in a protected area, out of season and without a license. My insurance agent grudgingly paid part of the medical costs. And my wife granted me reluctant permission to buy another spinning rod—if and when I can afford one—after ordering me, on pain of setting fire to my shack, never ever to practice again my Indiana Rope Trick.

I promised not to, of course, considering this to be a great, though necessary, sacrifice. It is, after all, the one thing I do really well.

But would you believe I already have had that promise put to the test?

Yesterday the doorbell rang at my house, repeatedly, insistently, as I ran up the steps from my basement shack to answer it. I found an agitated young man on my front stoop, jumping up and down in apparent excitement.

"Those are locust trees," he said breathlessly, jerking his thumb at an angle upwards towards the antenna in my backyard. "You got an antenna hangin' from 'em up there 50, 60, maybe 70 feet high. How'd you do that?"

"It was easy," I told him. "I put ropes in their tops when they were saplings. Then I waited for them to grow."

He stared at me in silence for a long time. Then he left, and sadly I watched him go. ■

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A Simple Way to Measure SSB PEP

Just stick out your tongue and say "ahhhhhhh."

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In the "good old days," compliance with the FCC's power regulations required nothing more than measuring dc power input to the final stage under steady-state conditions. All you had to do was multiply plate voltage times plate current on the final tube(s) or transistor(s). A kilowatt was a kilowatt: 2000 volts times 500 mA = 1000 Watts. That's a kilowatt, and that was the legal limit.

Then, single-sideband suppressed carrier came along and knocked ordinary power-measurement practices into a cocked hat. How do you measure dc power input with a plate ammeter that jumps all over? Even the ARRL didn't know—and apparently still doesn't. Nonetheless, there was and is a way. And it doesn't require the use of a calibrated oscilloscope, LEDs, so-called PEP wattmeters, or magic. Mind you, we now have to be concerned only with *output* power, not dc input power.

The FCC has defined peak envelope power (output) as "the average power during one radio frequency cycle at the crest of the modulation envelope, taken under normal operating conditions." I'm not really sure why the FCC included the word "average" in the definition when speaking of peak, or crest, but I think I know what they mean: the *maximum* power coming out of the transmitter or final amplifier.

Let's look at the simplest example, a maximum legal limit CW (A1) grounded-grid linear amplifier. We will use existing equipment found in most ham shacks. The FCC says we are limited to 1500 Watts PEP (output). All we have to do is tweak, peak, and load until the in-line wattmeter shows 1500 Watts of rf. That is 1500 Watts PEP (output) and presently the maximum we are allowed. Wasn't that simple? We didn't have to make plate-voltage times plate-current calculations, and we didn't have to apply any "fudge factors" to the wattmeter indication. We didn't even have to include the rf drive power from the exciter.

It isn't quite as simple to calculate the A3J (SSB) PEP output measurement, but it's not very hard to do, and you can do it with the same average-reading wattmeter that you already have—the Heath HM-102, Drake W-4, or the like. But we will have to take into consideration certain dc-power input parameters, plate voltage, and plate current.

The example given here presumes that the final amplifier has been properly loaded into a nonreactive load, be it dummy load or antenna, or through an antenna coupler (transmatch, matchbox, L-network, etc.). The use of a suitable monitor scope, such as the Heath SB-610, SB-614, or the like, is indispensible for proper loading of a kW amplifier. See "Tweaking Your Linear," *73*, October, 1978.

Let's say that our amplifier is the venerable Heath SB-220 (two 3-500Zs), and we have adequate drive power to run it up to about 1500 Watts output on CW. That will take an exciter capable of from 135 to 150 Watts output on CW. After tweaking, peaking, and loading—really trying hard!—the wattmeter shows only 1200 Watts. At the same time, the plate-voltage meter indicates 2500 volts and the plate ammeter shows 800 mA. This is typical. Amplifier efficiency seems to be 60% (1200 Watts out divided by 2000 Watts in = 60%) in a fully loaded condition, and that is reasonable.

Would you believe that these conditions also will produce the 1500 Watts PEP (output) that we are looking for? They will, and I will tell you why.

Under the full load of 800 mA, plate voltage was 2500. With no load plate, voltage was about 3000—not perfect regulation but what you'll find in most cases. Switch the exciter to SSB operation and set the mike gain to show desired ALC indication while saying "ahhhhhhh" into the mike.

Take a deep breath and say "ahhhhhhh" again, but this time notice and record the plate-voltage indication. Is it 2800 volts? Let's say that it is. The current drain on the power supply has pulled the plate voltage down from 3000 to 2800, and the lighter duty cycle of your "ahhhhhhh" (compared with the constant duty cycle of your carrier) has

THE RIGHT WAY TO GET EXCITED

Correct adjustment of the exciter is very important. It seems that many ops are confused by the "Mic/CW" or "Carrier Level" controls on their rigs. They are under the misapprehension that the CW-level pot also controls the output level of an SSB signal. On *some* solid-state rigs, it will; on most, it won't. Usually, therefore, during SSB operation, the CW or carrier-level control is inoperative and has absolutely no effect on SSB output power.

Whether or not it does can easily be established (without even reading the manual). Tune up the rig as usual. Note CW/Tune output power with the CW carrier-level control full up, fully clockwise. Let's say it is 100 Watts. Without changing any adjustments, switch to SSB operation and whistle into the mike a clear, steady tone. Sustain the whistle and adjust the CW carrier-level control. If there is no change in output power, the control is inoperative on SSB.

If the carrier-level function is controlled by the same knob as used for microphone level, use the whistle test and note output power at the point where the ALC meter or indicator begins to show ALC activity. The power level indicated on the wattmeter is approximately the actual output power of the exciter under SSB conditions.

allowed it to be somewhat higher than 2500—12% higher. *This is the key factor in determining PEP under voice conditions!*

Ohm's Law (I = E/R) prevails. An increase in E (voltage) produces a corresponding increase in I (current) when R (resistance) is constant. If the high voltage increases by 12%, then plate current increases by 12%. So: 2800 x (.800 x 1.12) = 2800 x .896 = 2508.8 Watts input. We have already determined that the loaded efficiency of the amplifier is 60%, and all we have to do to find the PEP output power of our SSB modulated signal is multiply plate-input power times the efficiency factor:

2508.8	plate-input power (dc)
x .60	efficiency factor
1505.28	PEP output (rf)

regardless of what the average-reading wattmeter says! I repeat: Regardless of what the average-reading wattmeter says! With an "ahhhhhhh," the HM-102 or W-4 might indicate only 200 Watts. If it shows much more, like 400 Watts, your processor is driving the pants off the final and you're probably splattering unnecessarily. (Is there ever "necessary" splatter?) Keep the processor turned off for the test.

Oh, you're wondering what to do about the illegal 5.28 Watts? Forget it. It's only .352 percent illegal. Or, if you're conscientious, unload the *exciter* by .352 percent. The amplifier is linear, isn't it?

Good luck! ■

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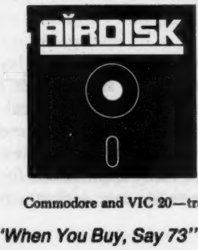

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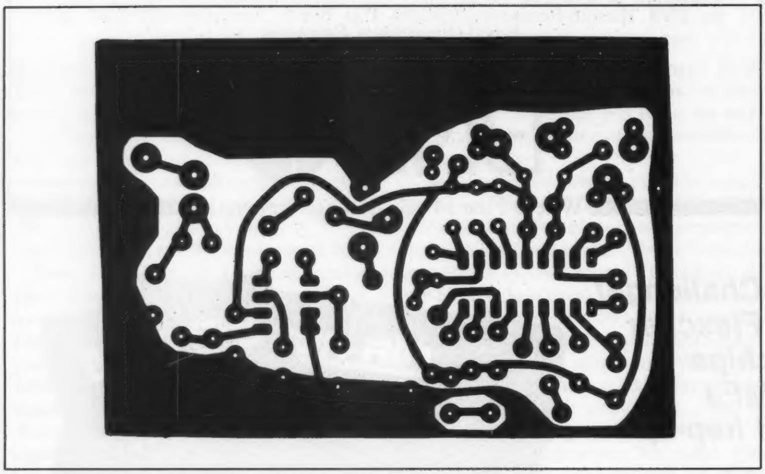


Fig. 1. Printed-circuit pattern, foil side.

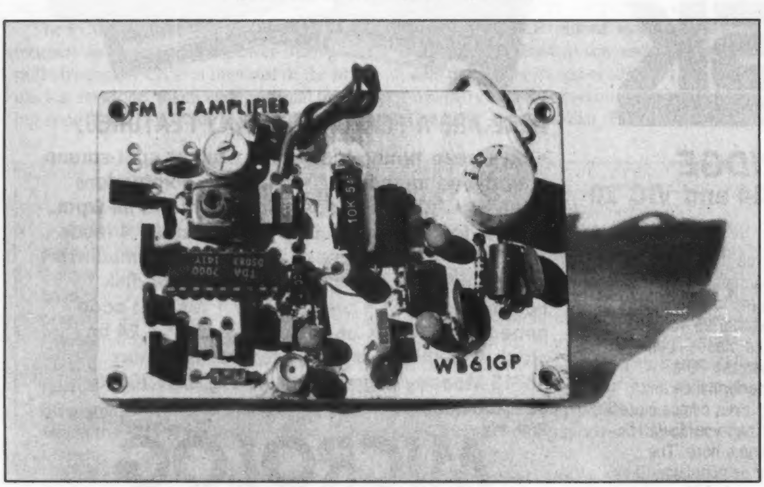


Photo A. The finished i-f amplifier. You can set the gain from 20 to 200 by simply swapping a few parts.

This versatile i-f amplifier is so easy to build and use it will amaze you. The heart of this project is the Signetics FM radio integrated circuit. Few external components are required to construct this very good quality, low-cost ($3 for the chip, in single quantities) FM radio or, in my application, an i-f strip. This is the first one-chip radio that I've made and the performance has astonished me. I've opened up many of the small imported radios and thought of converting them for monitor use on different frequencies, but the modifications proved to be futile, took too much effort, and expended a lot of time.

What I was looking for was an FM amplifier strip that was small enough to be mounted inside several different kinds of test equipment or other communication devices such as Gunnplexers, spectrum analyzers being used as system monitors, and 30- and 70-MHz test-bench i-f amplifiers. The primary use I have in mind is an FM i-f amplifier for use with a 10-GHz transceiver that I am building. The plan is to set the amplifier up on 30 MHz and enclose it within the transceiver's case—instead of using an old FM car radio. Besides, the current drain reduction and the size and weight make this package very attractive for portable work.

The good old FM car radio worked well as long as you stayed close to its original frequency range. Pulling them down to 70 MHz worked OK, but having a stereo receiver tied to the side of my microwave receiver just looked a little tacky, and it was bulky. Something smaller was required, and this chip from Signetics proved more than satisfactory.

PC Design

After I obtained the parts, I started to lay out a test circuit. It worked so well that I constructed a printed circuit board—I realized that I would be building several of these circuits for receivers and other pieces of test equipment. There are many applications for this i-f amplifier due to the ease with which it can be moved from one frequency to another. The maximum frequency that the chip will perform at is about 115 MHz. Sensitivity is 3 microvolts for a detectable signal with slight noise, and about 5 microvolts for full quieting.

The Chip

The chip requires 5 volts and draws about 8 mA. The only function that needs alignment is the resonant circuit for the oscillator (a parallel coil and capacitor). All other functions are taken care of on board the chip. The internal i-f amplifier runs at 70 kHz and is a frequency-locked loop. Sensitivity is obtained by the use of active RC filters. I was very surprised to find that Signetics had packed so many functions onto one relatively small chip! They include an rf input stage, mixer, local oscillator, i-f amplifier/limiter, phase demodulator, and a mute detector.

Construction

I started the printed-circuit layout with two-to-one templates using the circuit suggested by Signetics. These templates have almost all of the commonly used components at double their normal size. This drawing aid makes laying out a printed circuit board very easy: I can shift components around with my eraser until I obtain the final design. The templates come in standard size (1:1) and double size (2:1) and are called PC Designer PC-1 (1:1) and PC-2 (2:1). They are made by the Tangent Template Company and are available through many of the electronic parts suppliers that advertise in *73*. (See Fig. 1 for the PC-board artwork).

I added a small low-power audio amplifier to the i-f amplifier so that the total current drain would be minimal. I chose the LM-386 because of its low battery drain and high gain. Again, the audio chip was designed to hold the number of external components to a minimum. This audio chip will complement the amplifier quite nicely. The audio level will not drive you out of the living room, but with 400 mW the audio level should be about right for most applications.

I could have used fewer components on the audio amplifier, but wishing to lay the board out only one time, I provided for all bypass and gain options (Photo A). This only adds three components to the basic design but I feel it's worth it. If you need to modify this circuit for other applications, the layout is there. The capacitor on pin 7 (10 uF) is used on higher-gain operation; the resistor and capacitor combination between pins 1 and 8 establishes the higher gain ratio. By leaving the pins open, the amplifier will provide a fixed gain of about 20. By adding these extra components, gain can be increased to 200. I have set the gain to 50 with the 1.27k resistor and the 10-uF capacitor.

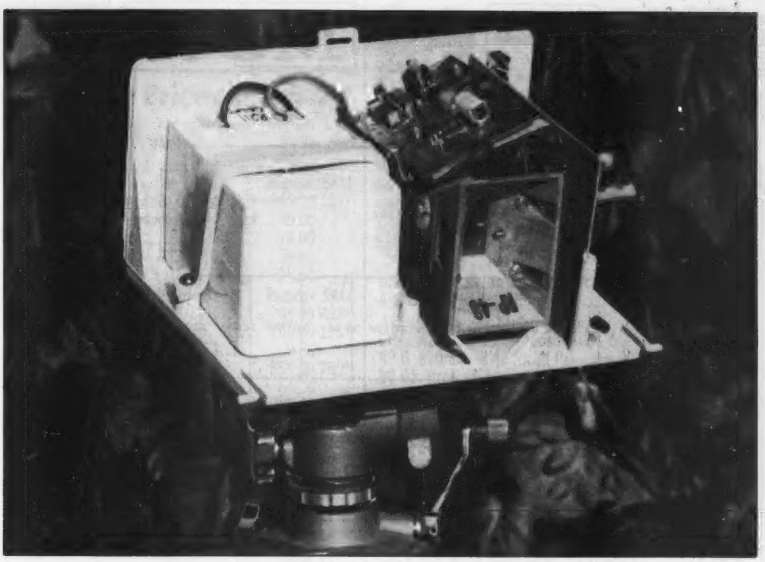


Photo B. The 10.250-GHz intrusion alarm used for a QSO with N6IZW. The i-f amp is on top of the stack.

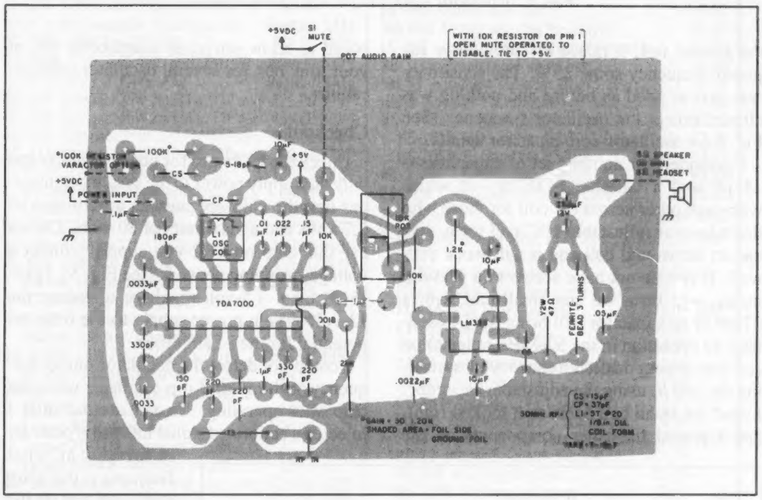


Fig. 2. Parts placement.

Preparation

I prepared the printed circuit board (Fig. 1) by taking a small drill (about 30 mils) and drilling out all holes except those that require grounding. (A good place to obtain very small bits is a model train store that specializes in construction of HO-gauge models.) Then take a larger drill, say 3/16 or so, and on the ground side of the board ream out the copper away from each hole. When the components and ICs are installed they will not touch any ground foil on top of the PC board. After the holes have been reamed out, drill the remaining ground holes and do *not* ream them. Component leads passing through the unreamed holes will be soldered to both sides of the printed circuit board, making for a very short ground.

The circuit might look a little unusual with most of the capacitors referenced to the dc bus; this is proper with this circuit. See the parts placement diagram (Fig. 2) and the system schematic (Fig. 3). Trying to refrain from using jumpers and very thin lines on the PC board, I had quite a time trying to figure out how to run a ground lead through the dc bus. I forgot about the upper ground surface—it was a natural. Grounding pin 3 of the i-f amp to the upper ground foil provided a very good shield and the shortest possible ground leads. When circuits are operating at frequencies such as this, the very short grounds are very desirable from a stability standpoint.

Local Oscillator

The local-oscillator coil circuit is the only part of the design that needed some tinkering with to make it work. I used a 1/8″-diameter coil form wound with 5 turns of #26 wire. With a 37-pF capacitor in parallel I was able to grid dip the circuit at about 50 MHz. The coil form had a shield, and when I placed the shield over the coil and soldered the case to

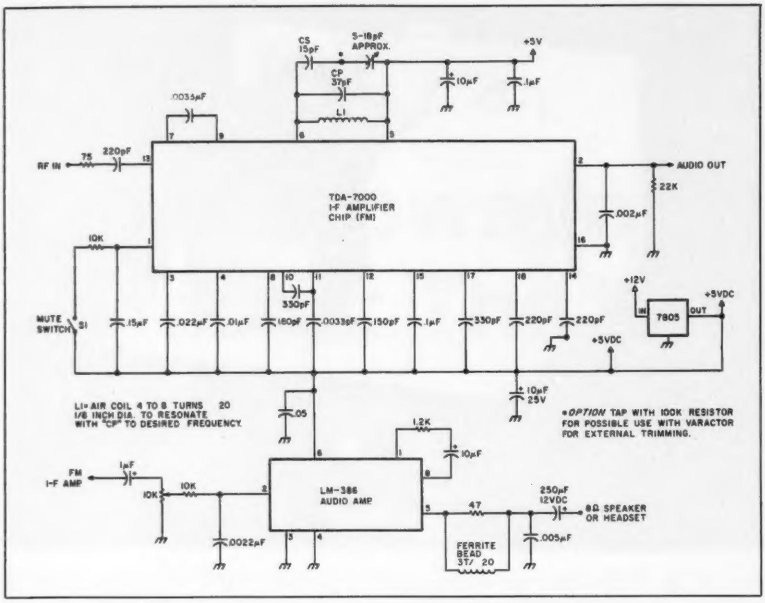

CS
15pF
5-18pF
APPROX.
+5V
CP
37pF
10μF
.1μF
.0033μF
L1
RF IN
75
220pF
TDA-7000
I-F AMPLIFIER
CHIP (FM)
AUDIO OUT
22K
.002μF
10K
MUTE
SWITCH
S1
.15μF
.022μF
.01μF
330pF
180pF
.0033pF
150pF
.1μF
330pF
220pF
220pF
+12V
IN
7805
OUT
+5VDC
+5VDC
10μF
25V
L1= AIR COIL 4 TO 8 TURNS 20
1/8 INCH DIA. TO RESONATE
WITH "CP" TO DESIRED FREQUENCY.
.05
*OPTION TAP WITH 100K RESISTOR
FOR POSSIBLE USE WITH VARACTOR
FOR EXTERNAL TRIMMING.
1.2K
10μF
FM
I-F AMP
1μF
10K
10K
LM-386
AUDIO AMP
250μF
12VDC
8Ω SPEAKER
OR HEADSET
47
.0022μF
FERRITE
BEAD
3T/ 20
.005μF

Fig. 3. Schematic diagram for the i-f amplifier.

the ground foil, it raised my previously adjusted frequency some 25%. The sensitivity was just as good as before and nothing was altered except the oscillator frequency. See Fig. 4 for oscillator-coil/capacitor details.

I provided for another set of capacitors—15 pF and a variable 2-18 pF—in series with each other across the coil for those who don't have an adjustable 1/8" coil form. Just use an air-wound coil and it will work very well. If you do not have access to a grid-dip meter, 4-5 turns on any small coil with a 37-pF or so capacitor will bring the i-f oscillator to operation in the 50-MHz range. You can trim to your desired frequency by spreading the coil or using the adjustable capacitor. I used the small coil because it looked right, and I placed the other components on the board to allow universal adaptability out of your junk box for several oscillator configurations.

Checkout

Check the PC board for possible shorts and *only then* apply power to the system. Remember that the chip operates on a minimum of 2.7 volts and a maximum of 10 volts. Do not use this chip on a 12-volt supply without a voltage-dropping network (see Fig. 3). I provided for a +5-volt regulator to reduce the 12-volt system power supply to the required potential for the i-f amplifier.

I could not detect the oscillator output frequency with my grid-dip oscillator when the chip was operating. To get around this, I injected a calibrated signal into the rf port. By observing at what frequency the chip locks you can set the oscillator to obtain the proper frequency by adjusting the coil-capacitor combination. Setting the oscillator coil and capacitor is the only adjustment that is needed. Lock-in range is aproximately 300 kHz.

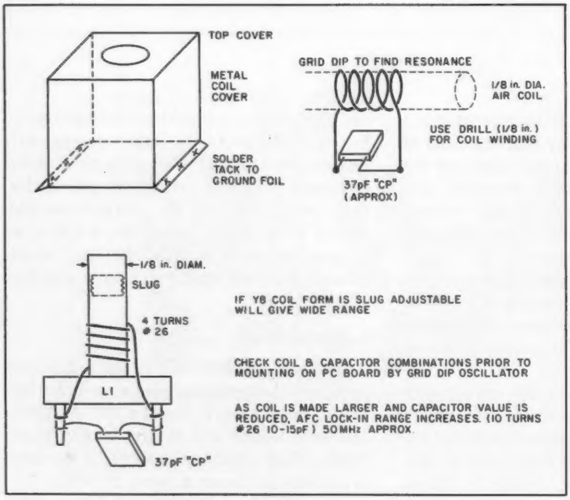

TOP COVER
METAL
COIL
COVER
SOLDER
TACK TO
GROUND FOIL
GRID DIP TO FIND RESONANCE
1/8 in. DIA.
AIR COIL
USE DRILL (1/8 in.)
FOR COIL WINDING
37pF "CP"
(APPROX)
1/8 in. DIAM.
SLUG
4 TURNS
# 26
L1
37pF "CP"
IF 1/8 COIL FORM IS SLUG ADJUSTABLE
WILL GIVE WIDE RANGE
CHECK COIL & CAPACITOR COMBINATIONS PRIOR TO
MOUNTING ON PC BOARD BY GRID DIP OSCILLATOR
AS COIL IS MADE LARGER AND CAPACITOR VALUE IS
REDUCED, AFC LOCK-IN RANGE INCREASES. (10 TURNS
#26 10-15pF) 50MHz APPROX.

Fig. 4. Some suggestions for winding the local-oscillator coil.

Applications

My first unit was installed on a 10-GHz transceiver (Photo B). The unit was not the familiar Gunnplexer, but rather a modified intrusion alarm detector (a Gunnplexer by another name). The alarm portion was defeated and disconnected and the detector output was modified to accept the i-f amplifier. The detector-output impedance is about 200 Ohms and the input of the amplifier is 75 Ohms. I've got to thank Kerry Banke N6IZW for all of his work on adapting the Gunnplexer, and so many other parts of this project, to the i-f amplifier. Without his help this project wouldn't have gotten off the ground.

We contemplated using a small matching pi network to resonate the input at 30 MHz to improve the match and prevent operation on another frequency (such as 60 MHz). We have not tried this out yet, but field trials will show whether it is needed. We think it might be possible for the frequency-locked loop to sense 60 MHz on a working 30-MHz amplifier, but this would only happen if our frequency, 10 GHz, was not properly set.

I also plan to install one of these boards in my spectrum analyzer, tapping off the existing i-f amplifier. Trial usage showed that operation was quite good. Due to the high sensitivity of the Signetics chip, a 1"-long piece of wire provided the needed coupling to give proper input. Now when I zero a pip on the oscilloscope I can also hear the modulation and be able to identify the signals a lot easier.

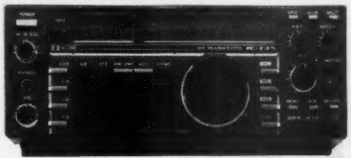
By using the amplifier on the workbench, alignment of converters and preamplifiers has been made easy. No longer do I have to disable and move the station receiver to the workbench to make repairs or modifications. I can leave the station connected and even use it on a break from a long building binge. You could even move the oscillator coil up to the commercial FM band and create a garage radio of excellent quality; although it's mono, the quality of audio is very good.

6 Meters

The neatest trick was the construction of a 6-meter monitor for the station. By connecting an external crystal-controlled oscillator to pin 6, I set the oscillator to receive 52.525 MHz. Now, with 3-uV sensitivity, six-meter signals blew the doors off of the receiver. I may construct several more for 2 meters or higher frequencies by placing converters in front of the i-f amplifier. With operation causing such a low current drain on the station's emergency battery pack, several units can be operated and not even dent existing battery operation. However, with the normal station transceivers and synthesizers running, the battery runs down.

I hope I have given you experimenters several good ideas on how to use the Signetics i-f amplifier chip, the TDA-7000. I have had lots of fun and plan to use it in even more applications. I would be happy to correspond with others interested in this project and other items related to microwave applications and test equipment.

A printed circuit board etched and ready for drilling is available from the author for those not desiring to construct one from the artwork provided in this article. The cost is $5 plus postage.■



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FL-54 270 Hz CW filter (1st IF)	53.00	
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FL-63 250 Hz CW filter (1st IF)	54.50	
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SP-7 Small external speaker	49.00	
CR-64 High stab. ref. xtal (745/751)	63.00	
PP-1 Speaker/patch....................	159.25	149^{95}
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SM-8 Desk mic - two cables, Scan.....	78.50	
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AG-1 Mast mounted preamplifier ...	99.50	
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AH-32 2m/440 Dual Band antenna ...	37.00	
AHB-32 Trunk-lip mount	34.00	
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Larsen PO-TLM Trunk-lip mount....	20.18	
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Simple low-pass or high-pass audio filtering has never seemed to be adequate to cope with the noise encountered on the ham bands. While looking through the 1982 *Radio Amateur's Handbook* published by the ARRL, I found information on voice formants and decided to build a crystal-controlled audio Switched Capacitor Filter (SCF) to take advantage of the noise-bandwidth reduction offered by that technique.

Formants are the groups of audio frequency energy that convey spoken intelligence. The voiceprints of courtroom fame are spectrograms of formants. The first formant extends from approximately 300 to 700 Hz, while the second and third span from 1,500 to 2,700 Hz.

The filter's SSB gain from input to output is unity, to allow switching between its output and your receiver's output without volume changes. The filter's response curve is shown in Fig. 1. The 3-dB bandwidth of this unit is 1,680 Hz for SSB mode in two-band segments between 300 and 3,000 Hz, with a bandpass filter (BPF) for the first formant and another BPF for the other two. In CW mode, bandwidths of 300 or 440 Hz can be selected by a front-panel switch.

In my shack, the audio from my Kenwood TS-830 loops through the input of this filter and then connects to the "A" input of my SP-230 external speaker. The output of the filter is connected to the "B" input of the SP-230, which has a front-panel A/B-selecting switch.

Circuit Operation

The SSB BPF sections are formed by cascading high-pass filters (HPF) and low-pass filters (LPF) to produce a BPF response. The particular switched capacitor filter chips used in this project are National Semiconductor MF10s. The MF10 has LPF, BPF, and HPF outputs, but the BPF output has a high enough Q that it cannot produce the desired voice bandwidths. In CW mode, four MF10 BPF outputs are cascaded to produce the narrow response, with a pickoff after the second BPF for the wider response.

To improve the stopband rejection at the lower corners of the SSB BPFs, their input coupling capacitors are chosen to produce additional rolloff below their band segments. All voices vary somewhat in frequency content, and a minor change here from component tolerances does not make a serious difference in intelligibility. Other capacitors are added to the basic application circuit to provide frequency shaping of the total response.

Capacitor C1 provides high-pass filtering

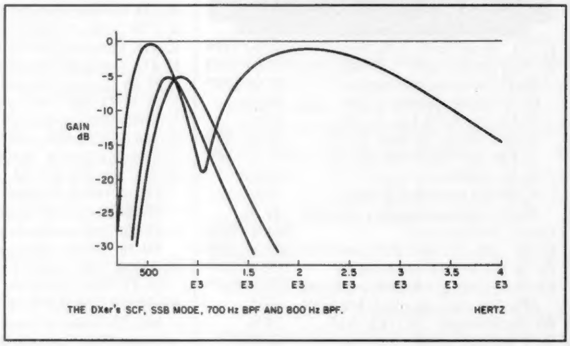

Fig. 1. The filter's response curve.

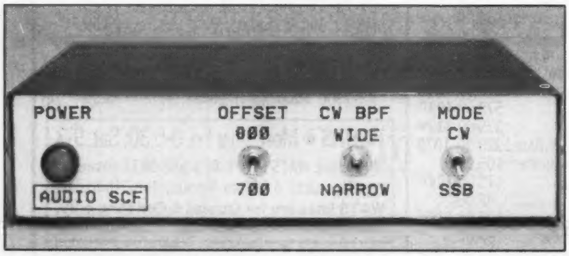

Photo A. The DXer's SCF.

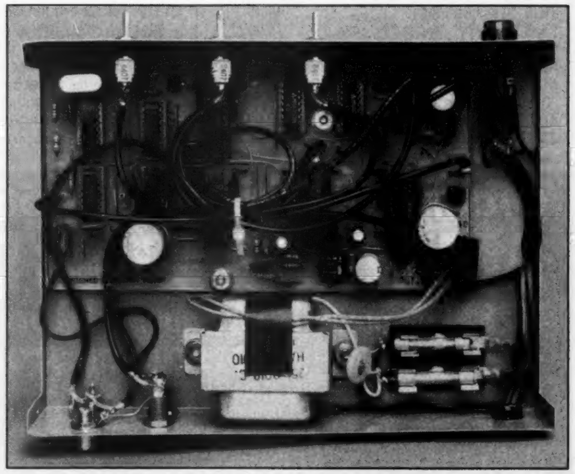

Photo C. Interior.

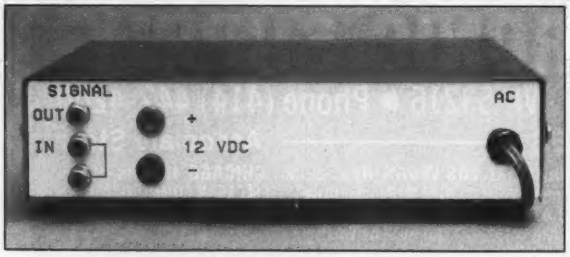

Photo B. Rear panel.

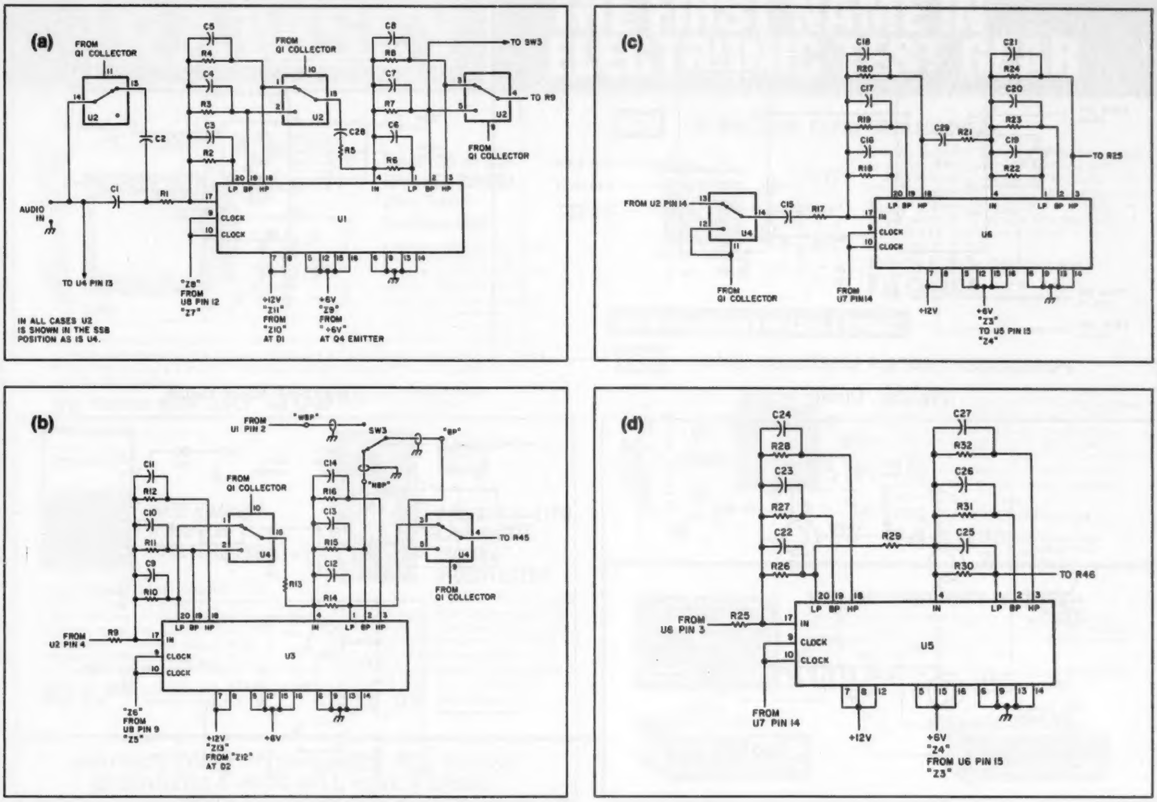
(a)
FROM Q1 COLLECTOR
U2
C2
AUDIO IN
C1
R1
R2
R3
R4
C3
C4
C5
U1
LP BP HP
CLOCK
CLOCK
TO U4 PIN 13
"Z8" FROM U8 PIN 12 "Z7"
+12V "Z11" FROM "Z10" AT D1
+6V "Z9" FROM "+6V" AT Q4 EMITTER
IN ALL CASES U2 IS SHOWN IN THE SSB POSITION AS IS U4.
C28
R5
R6
R7
R8
C6
C7
C8
TO SW3
TO R9
FROM Q1 COLLECTOR
(b)
FROM U1 PIN 2
"WBP"
SW3
"BP"
"NBP"
FROM Q1 COLLECTOR
U4
U3
FROM U2 PIN 4
R9
R10
R11
R12
C9
C10
C11
R13
R14
R15
R16
C12
C13
C14
TO R45
"Z6" FROM U8 PIN 9 "Z5"
+12V "Z13" FROM "Z12" AT D2
+6V
(c)
FROM U2 PIN 14
C15
R17
U4
FROM Q1 COLLECTOR
FROM U7 PIN14
C16
C17
C18
R18
R19
R20
C29
R21
C19
C20
C21
R22
R23
R24
TO R25
U6
+12V
+6V "Z3" TO U5 PIN 15 "Z4"
(d)
C22
C23
C24
R26
R27
R28
R29
C25
C26
C27
R30
R31
R32
TO R46
FROM U6 PIN 3
R25
U5
FROM U7 PIN 14
+12V
+6V "Z4" FROM U6 PIN 15 "Z3"

Fig. 2(a)–(d). Four National MF10s are cascaded to produce the desired filter shape.

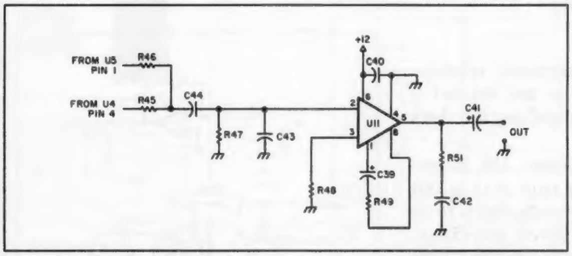
FROM U5 PIN 1
R46
FROM U4 PIN 4
R45
C44
R47
C43
+12
C40
U11
C39
R48
R49
R51
C41
C42
OUT

Fig. 2(e). Output driver.

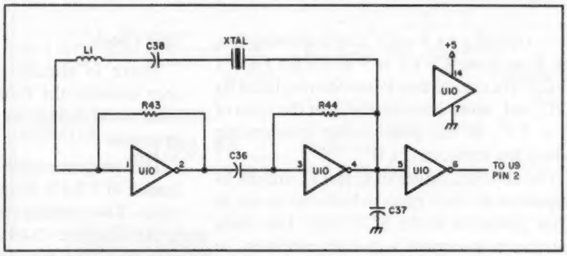
L1
C38
XTAL
+5
U10
R43
R44
U10
C36
U10
U10
C37
TO U9 PIN 2

Fig. 2(f). System clock.

for CW mode by reducing response below 700 Hz. In SSB mode, C2 is switched in parallel with C1 to extend the response to below 500 Hz—Fig. 2(a). In the lower formant BPF, C28 provides additional rolloff below 400 Hz. The second formant BPF (U5 and U6) uses C15 and C29 similarly—Figs. 2(c) and 2(d).

The lower formant section is used for the CW filter. Since the bandwidth of the fourth cascaded BPF output is 350 Hz with an 800-Hz offset and is 300 Hz for a 700-Hz offset, it seems unnecessary to add more stages. There is a problem with very narrow CW filters in ease of receiver tuning and with receiver and transmitter drifts, which can require annoyingly frequent retuning of your receiver.

It is interesting to note that in the wide CW filter position you can understand SSB transmissions. While reception is not as clear as in SSB operation of the filter, it does remove a lot of background noise.

The CW BPF is created by switching the original topology of HP-HP-LP-LP to BP-BP-BP-BP via U2 (Fig. 2(a)), U4 (Figs. 2(b) and 2(c)), and Q1 (Fig. 2(i)). Each MF10 contains two filters that account for these HP and LP pairs. To keep the unused higher formant section from contributing noise in CW mode, its input is ac grounded by U4.

The output driver, U11 (Fig. 2(e)), will drive an 8-Ohm load with a 2-V rms signal. U11's gain is 20 without using R49 and C39, giving a total gain of 1:1 for the unit. Additional gain is available if R49 and C39 are added to the board. For example, R49 = 1,200 Ohms yields a gain of 50 in U11. C43 provides the final high-frequency rolloff.

SCF Theory

SCFs are basically integrators that are interconnected to provide HP, LP, BP, and NOTCH functions.

The active LPF, Fig. 3(a), has gain V2/V1 = −1/(6.28 x f x R x C). To show that resistor R can be replaced by switched capacitor C_s (which acts like an equivalent resistor, Req), consider Fig. 3(b).

During the portion of the clock signal that turns on Q1 and turns off Q2, capacitor C_s will acquire charge Q_s. When the clock signal changes state, Q1 will turn off and Q2 will turn on. The current flowing to the op amp will be $I_{in} = Q_s$/(unit time), where $Q_s = C_s$ x V1. The input current I_{in} = V1/Req = Q_s/T, where T is the clock period. Therefore, Req = (V1 x T)/Q_s = (V1 x T)/(C_s x V1), or Req = T/C_s.

Again, from Fig. 3(a) we know that V2/V1

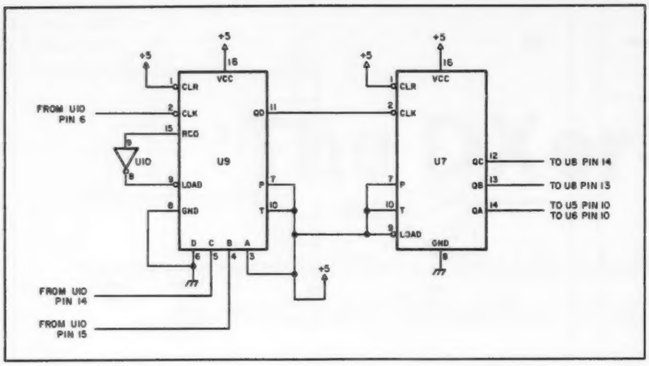
+5
+5
16
VCC
CLR
CLK
RCO
LOAD
GND
U9
QD
P
T
D C B A
FROM U10 PIN 6
U10
FROM U10 PIN 14
FROM U10 PIN 15
+5
+5
16
VCC
CLR
CLK
U7
P
T
LOAD
GND
QC
QB
QA
TO U8 PIN 14
TO U8 PIN 13
TO U5 PIN 10
TO U6 PIN 10

Fig. 2(g). Divider section.

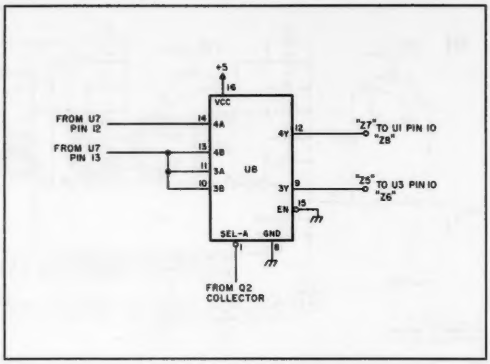
+5
16
VCC
FROM U7 PIN 12
FROM U7 PIN 13
4A
4B
3A
3B
U8
4Y
3Y
EN
SEL-A
GND
"Z7" TO U1 PIN 10
"Z8"
"Z5" TO U3 PIN 10
"Z6"
FROM Q2 COLLECTOR

Fig. 2(h). Clock switch.

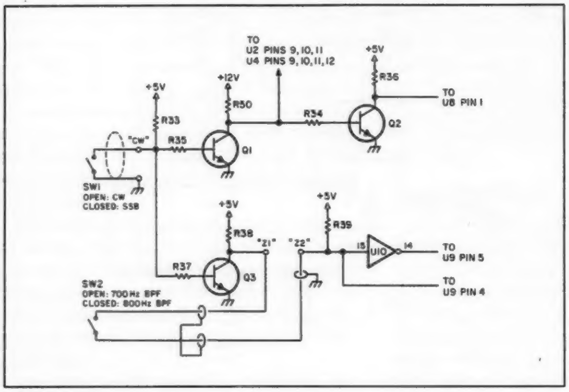
TO
U2 PINS 9, 10, 11
U4 PINS 9, 10, 11, 12
+5V
+12V
+5V
R33
"CW"
R35
R50
R34
Q1
R36
Q2
TO U8 PIN 1
SW1
OPEN: CW
CLOSED: SSB
+5V
R38
"Z1"
"Z2"
+5V
R39
U10
R37
Q3
TO U9 PIN 5
TO U9 PIN 4
SW2
OPEN: 700Hz BPF
CLOSED: 800Hz BPF

Fig. 2(i). Mode and offset selection.

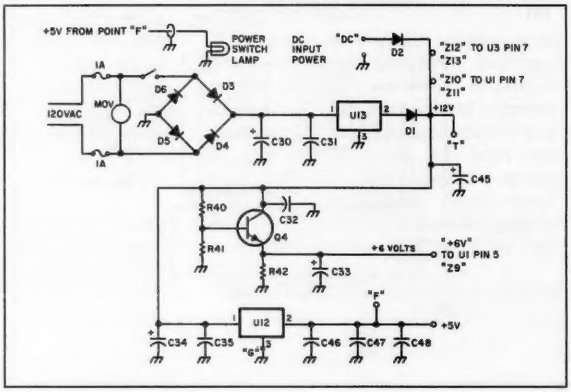
+5V FROM POINT "F"
POWER SWITCH LAMP
DC INPUT POWER
"DC"
D2
"Z12" TO U3 PIN 7
"Z13"
"Z10" TO U1 PIN 7
"Z11"
1A
1A
120VAC
MOV
D6
D3
D5
D4
C30
C31
U13
D1
+12V
"T"
C45
R40
C32
Q4
R41
R42
C33
+6 VOLTS
"+6V"
TO U1 PIN 5
"Z9"
"F"
U12
"G"
C34
C35
C46
C47
C48
+5V

Fig. 2(j). Power supply.

$= -1/(6.28 \times f \times R \times C)$, so substituting Req for R we have $V2/V1 = -1/(6.28 \times f \times C \times T/C_s)$. We can see that R has been replaced by T/C_s and, more importantly, that the ratio of $C \times T/C_s$ is the gain-setting relationship which has replaced C x R.

The absolute values of C and C_s are not as important as their ratio, which can be set to great precision in the SCF chip. The clock can also be generated with high precision, so the main variable in the circuit's gain is the input frequency. A symmetrical clock signal is needed to provide equal charging and discharging time for C_s. There are many sources of data on SCF theory, so I will not go into more detail here.

A look at the MF10 in a data book shows nine different configurations for this versatile IC. The cutoff frequency or the bandpass frequency in each application circuit depends on resistor ratios and on the absolute value of the clock frequency. To keep the resistor ratios under control, along with their cost, I use resistor packs for these components. The absolute value of the R-packs is not as important as the ratio between the resistors on a given half of an MF10. This ratio in the R-packs is on the order of 0.5%.

Clock Generator

The clock is based on a 3.58-MHz crystal oscillator, U10, which is divided down by binary counters U9 and U7—Fig. 2(g).

SSB Clock

There is almost a harmonic relationship between the formants, and that fact is used to advantage in simplifying the clock generator.

The programmable divider, U9, is preloaded to 3 for a dividing ratio of 13 in SSB mode. The terminal count of the chip is 16, at which time the CARRY OUTPUT, pin 15, enables the LOAD pin via an inverter and loads the preset count at the next positive edge of the 3.58-MHz clock. The CARRY OUTPUT at 3.58/13 MHz is also used to clock U7, which is a binary counter producing the divide-by-2 and divide-by-4 ratios mentioned later.

In SSB mode, the 3.58-MHz signal is divided by 13 in U9 and then by 2 in U7 to produce a 137,674-Hz clock signal for the upper formant BPF.

An MF10 can be set for a clock/corner frequency ratio of 50 or 100. In the upper formant BPF, the X100 section, U5, has a passband starting at 1,376 Hz—Fig. 2(d). The following LPF section, U6, with its X50 ratio, has a passband ending at 2,753 Hz—Fig. 2(c). These two filters form a BPF from 1,376 to 2,753 Hz.

The lower formant BPF is wired for clocking at the X100 ratio in both U1 (Fig. 2(a)) and U3 (Fig. 2(b)) to simplify the switching between SSB and CW operation. To obtain the proper SSB clocks for the lower formant, the 137,674-Hz signal is divided by 2 for U3 and by 4 for U1 to yield 68,837 and 34,418 Hz, respectively, and a BPF of 344 to 688 Hz.

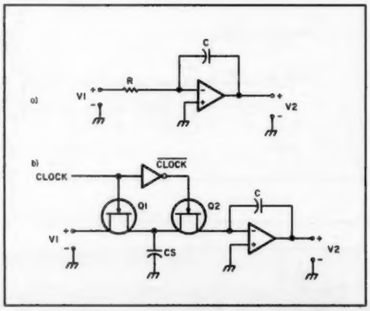
a)
C
V1
R
V2
b)
CLOCK
CLOCK
Q1
Q2
C
V1
CS
V2

Fig. 3. The switched capacitor filter is derived from a simple active low-pass filter.

CW Clock

The lower formant BPFs, U1 and U3, require identical clock signals in CW mode, which are selected in U8 (Fig. 2(h)) as controlled by Q2 (Fig. 2(i)).

The two most popular CW offsets are 700 Hz and 800 Hz, which can be selected by switch SW2. In the case of a 700-Hz offset, the divider ratios are 13 and 4, which yield a 68,837-Hz clock signal. The X100 setup

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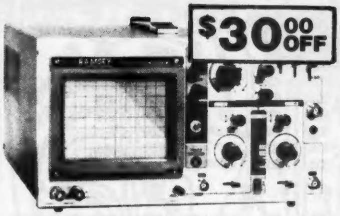

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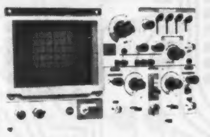

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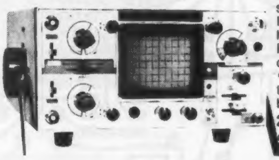

Ideal for field/bench applications, this scope can display up to 15 MHz signals. Internal battery pack allows up to 2 hours operation on a single charge. Features include • built-in battery charger • 5X horizontal magnification • high brightness CRT • front panel trace rotator • internal rechargeable battery pack

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BP-4 nicad pack	8.95

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CT-90 kit	$149.95
OV-1 0 1 PPM oven timebase	59.95
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BP-4 nicad	$8.95

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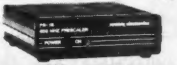

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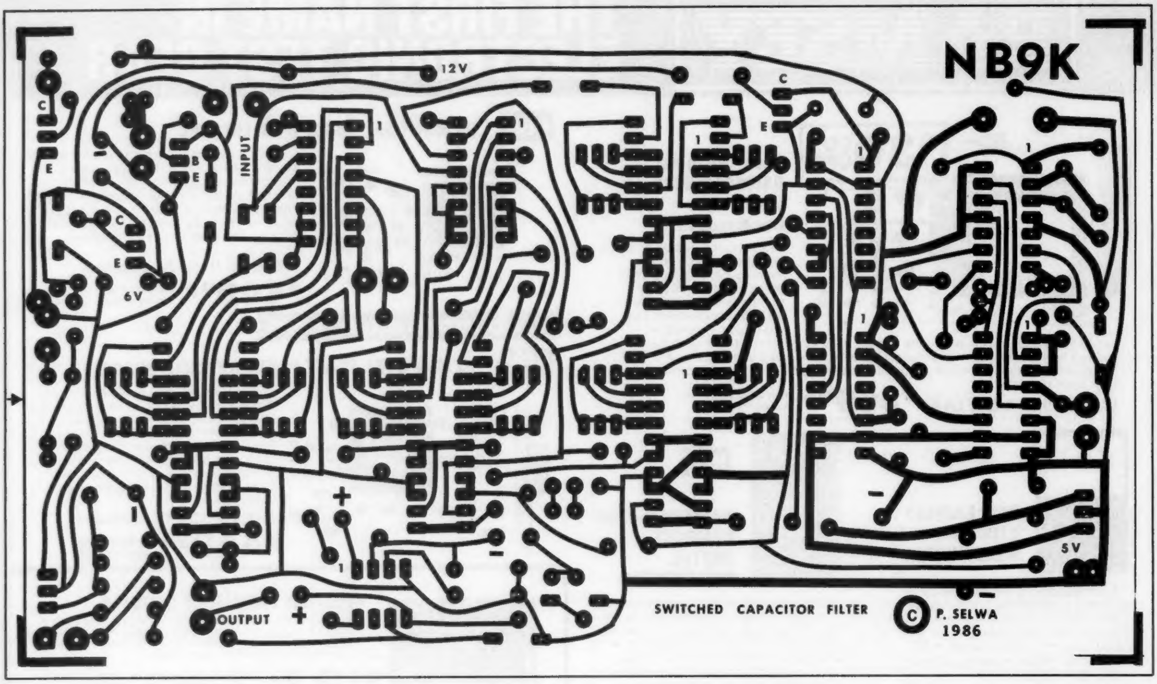
NB9K
12V
INPUT
6V
OUTPUT
5V
SWITCHED CAPACITOR FILTER
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Fig. 4. Circuit board, foil side.

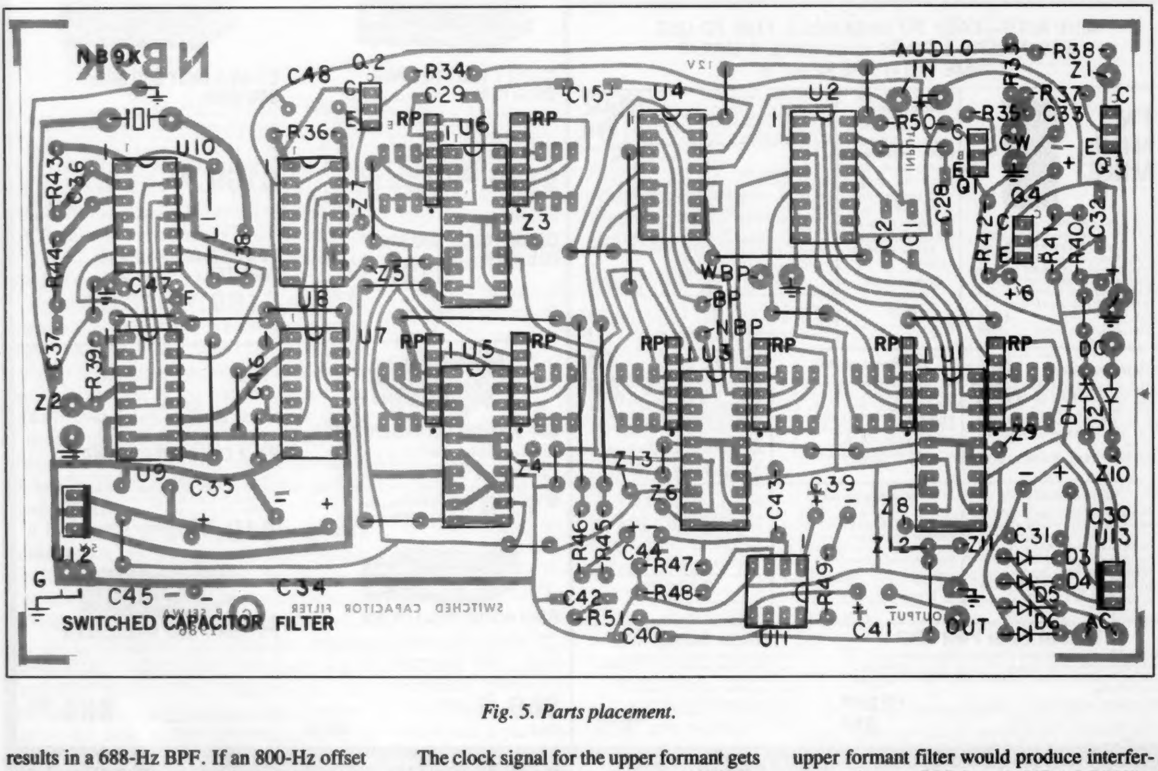

NB9X
Q2
R34
C48
C29
C15
U4
U2
AUDIO IN
R38
R33
Z1
R36
U6
U10
R50
R35
R37
C33
Q3
CW
Q1
Q4
R43
C36
Z3
C2
C1
C28
R42
R41
R40
C32
R44
C38
Z5
WBP
BP
NBP
+6
C47
U8
U7
U5
U3
U1
C37
R39
C46
D1
D2
Z2
Z9
Z4
Z13
Z6
C43
C39
Z8
Z10
U9
C35
R46
R45
C44
R47
Z12
Z11
C31
C30
U13
U12
D3
D4
R48
R49
D5
G
C45
C34
C42
R51
C40
U11
C41
OUT
D6
AC
SWITCHED CAPACITOR FILTER

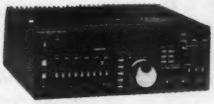
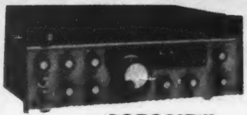
Fig. 5. Parts placement.

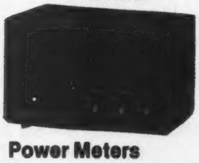
results in a 688-Hz BPF. If an 800-Hz offset is chosen, the dividers are 11 and 4 to produce a clock frequency of 81,353 Hz. The coupling caps for U1 cause the total response to peak at 732 and 846 Hz, but the response at 700 and 800 Hz is less than 0.2 dB down from maximum.

The clock signal for the upper formant gets changed during CW operation at 800 Hz since divider U9 (Fig. 2(g)) is set to 11 rather than to 13. The audio input to the upper formant BPF is ac grounded at U4 pin 14 (Fig. 2(c)) during CW mode so the output stage is not affected. Without this muting, the upper formant filter would produce interference acting as a BPF from 1,627 to 3,254 Hz.

Power Supply

The power supply is a conventional transformer/diode bridge/regulator combination. The 12-V regulator's output passes through



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9269	1600B	RG62A/U Poly 96%	15.00	.17
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diode D1, which protects the regulator from externally applied voltages—Fig. 2(j). An external dc power supply can be applied to the unit at point "DC" via diode D2 in the case of battery operation, or from the accessory socket on another piece of equipment. D2 protects against polarity reversals. You can apply an external dc supply through the diode bridge, but this requires about 17 volts to get regulated +12 volts. This unit draws about 75 mA dc with no signal applied. For low-level audio applications such as for headphones, a 12.6-volt transformer is enough to power the unit. For full capability, however, use an 18-volt power transformer. The +6-volt supply is for biasing the internal amplifiers in the MF10. Its exact value is not critical.

Assembly

There are no adjustments and there is nothing critical about assembling this project. All components are available from sources such as Digi-Key, Jameco, All Electronics, and Radio Shack.

The selection of CW or SSB mode is made by grounding point CW on the board with switch SW1 for SSB mode, or letting it pull up via R33 for CW mode—Fig. 2(i). The default CW filter is at 700 Hz, and you can select the 800-Hz BPF by connecting points "Z1" and "Z2" with switch SW2. Select the narrow or wide CW BPF by connecting SPDT switch SW3 to points NBP, WBP, and BP with the pole at BP. In addition to the jumpers shown as straight lines on the parts placement diagram, connect the points: Z3–Z4 (Figs. 2(c) and 2(d)), Z5–Z6 (Figs. 2(b) and 2(h)), Z7–Z8 (Figs. 2(a) and 2(h)), +6–Z9 (Figs. 2(a) and 2(j)), Z10–Z11 (Figs. 2(a) and 2(j)), and Z12–Z13 (Figs. 2(b) and 2(j)). Point "F" is a +5-volt pickoff and point "T" is a +12-volt pickoff for pilot lights—Fig. 2(j).

To avoid hum problems, use shielded wire wherever possible. There is a point to ground the crystal's can, and there are holes near U12 labelled "G" to use in making ground connections—Fig. 2(j). I had to connect from "G" to ground at the rear-panel output jack to take out hum.

Space is provided for an LC resonant circuit (L1, C38) in series with the crystal in case yours requires it to operate correctly; otherwise, jumper their spaces—Fig. 2(f). Add C37 to aid in oscillator startup as required.

There is room for IC sockets, and the spaces for the resistor SIP packs are laid out so they can be inserted in either direction, but the dot on the component layout marks the common point (the MF10's input summing junction). Capacitors C3–C14 (Figs. 2(a) and 2(b)) and C16–C27 (Figs. 2(c) and 2(d)) are shown on the schematic and there are holes on the board for them, but they are there for experimentation and the unit works fine without them. Check a data book for the internal schematic of the MF10 before adding any of those caps.

The 12-V regulator requires a heat sink, but the 5-V regulator does not unless you use TTL equivalents in the clock generator. ■

Parts List

C1, C28	0.018 uF
C2, C36	0.01 uF
C31, C32, C35, C40, C46, C47, C48	0.1 uF
C3–C14*	
C15	0.0039 uF
C16–C27*	
C29	0.0027 uF
C30, C34, C45	220 uF, 50 V
C33, C41	100 uF, 25 V
C37*	10 pF
C38*	180 pF
C39**	10 uF, 25 V
C42	0.047 uF
C43	0.15 uF
C44	2.2 uF, 25 V
D1–D6	1N4002
L1*	10 uH
Q1–Q4	2N2222 or 2N3904
RP1–RP8 (R1–R32)	Resistor SIP 5@ 22 k Digi-Key #Q5223
R33, R34, R36, R38, R39	10 k, 1/8 W
R35, R37, R48, R50	1 k, 1/8 W
R40, R42	4,300 Ohm, 1/8 W
R41	5,600 Ohm, 1/8 W
R43, R44	820 Ohm, 1/8 W
R45	24,000 Ohm, 1/8 W
R46	7,500 Ohm, 1/8 W
R47	1,600 Ohm, 1/8 W
R49**	1,200 Ohm, 1/8 W
R51	10 Ohm, 1/8 W
SW1, SW2	SPST toggle switch
SW3	SPDT toggle switch
U1, U3, U5, U6	MF10CN
U2, U4	CD4053B
U7, U9	74C163
U8	74C157
U10	74LS04
U11	LM386N
U12	LM7805CT
U13	LM7812CT
XTAL	3.58-MHz crystal
Transformer*	18-V rms @ 600 mA All Electronics—TX-186 Radio Shack—273-1515
Heat sink (for U12)	RS 276-1367
Fuse holders	RS 270-739
Power switch	RS 275-677
Cabinet	RS 270-272
Fuses	1 Ampere
3 phone jacks	
2 banana jacks	
Metal-oxide varistor	

* see "Assembly" section.

** see "Circuit Operation" section.

BUILD THE KIT

A complete set of parts, including everything required to build the kit, is available from Valley Electronics. The kit version is slightly different from the unit presented in this article. The kit includes the "optional" capacitor and resistor for additional gain, a headphone jack, and a filter in/filter out switch. The circuit board is double-sided, and the entire unit is housed in an attractive cabinet with wood-grain end panels.

Order Number	Description	Price
98601	Complete SCF Kit	$119.95

The price includes shipping and handling.

Send your check or money order to Valley Electronics, PO Box 1101, Hillsboro NH 03244.

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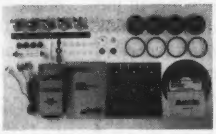

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One Band, One Transistor

Build this tiny ham band receiver and put the world in your pocket.

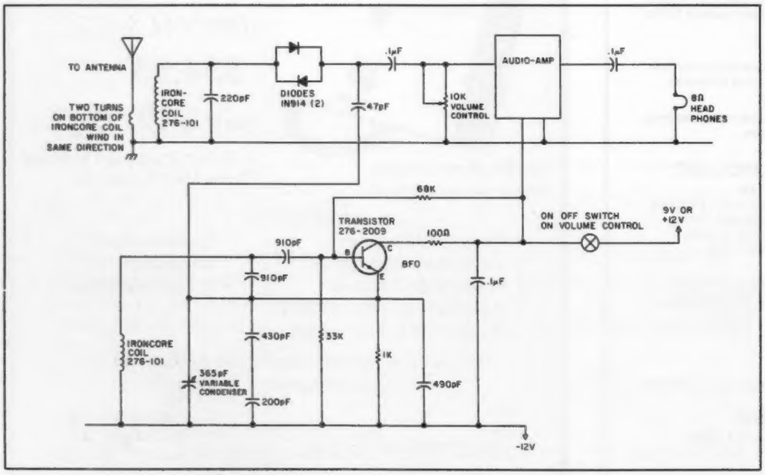
Number 8 on your Feedback card

Here is a very simple little receiver that most anyone electronically inclined can build. You can use it to listen to your favorite ham band when you're away from the shack.

The circuit in Fig. 1 is configured for the 80m band. All of the parts can be found in your local Radio Shack store. A good way to build this project would be to use a single-sided printed circuit board. Additionally, you will need either a 9-volt or a 12-volt battery, an audio amp module (you can build your own using a 741 IC; I will send a wiring diagram to you for an SASE), and 8-Ohm headphones. The 365-pF broadcast-band variable capacitor should have a vernier drive (six-to-one ratio), which makes tuning easier by separating the stations on the dial. A good antenna and ground are also recommended.

With just a few changes in capacitance and inductance values, this receiver should work well on other ham bands. For example, you could install the receiver in a broadcast-band transistor radio. Instead of using an external audio amp, you would use the one in the radio—just run a wire from the wiper of the 10k volume control to the middle terminal of the volume control in the broadcast receiver. You should connect the grounds of the two radios together. The 9 or 12 volts needed to power the one-transistor radio would be taken from the on/off switch on the back of the volume control.

The Radio Shack iron-core chokes (276-101) that are used in the bfo part of the circuit can be calibrated by listening for the bfo signal in a calibrated receiver. This bfo coil is placed in a horizontal position in relation to the copper foil of the printed circuit board, and the distance between the side of the bfo coil and the copper foil of the printed circuit board determines the band edge's low and high limits. Tuning of the bfo coil is accomplished by varying the distance between the side of the bfo coil and the copper foil. The inductance value of the bfo coil is 10 mH.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AUDIO-AMP
.1µF
8Ω HEAD PHONES
68K
TRANSISTOR 276-2009
100Ω
ON OFF SWITCH ON VOLUME CONTROL
9V OR +12V
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B
C
E
BFO
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.1µF
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33K
1K
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490pF
200pF
-12V

Fig. 1. This tiny single-band receiver will fit into your pocket.

> ***"With just a few changes in capacitance and inductance values, this receiver should work well on other ham bands."***

This one-transistor receiver also could be made into a very small pocket ham-band receiver, which would be good for SWLs and hams to listen to when away from home, to keep in touch with their favorite nets and skeds. It may be possible to increase the volume by installing a small output transformer (500 to 8 Ohms) between the output terminals on the other side of the .1-uF capacitor. Run the 500-Ohm side to the capacitor and ground, and the 8-Ohm side to the 8-Ohm headphones.

I hope you enjoy building and operating this simple receiver. If you have any questions, you can write to me at the address at the beginning of this article. ■

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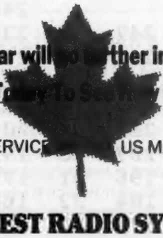

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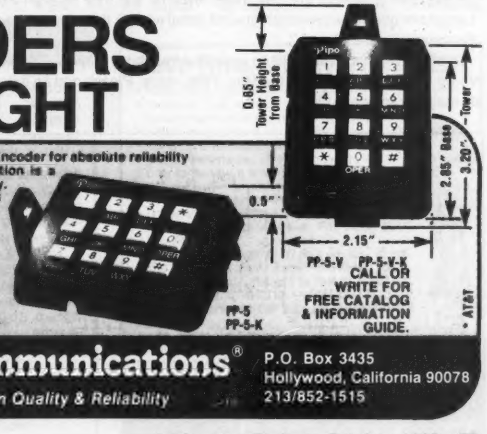

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SPECIAL EVENTS

WEST COVINA CA
OCT 4

The Southern California Amateur Transmitting Society will sponsor Scatcon '86 on October 4, from 9 a.m. to 3 p.m., at Cortez Park, 2441 Cortez Avenue, West Covina, California. $2 donation. Talk-in on 147.765/.600. For more information, call Bob N6NGN at (818)-917-6470.

NORWOOD NJ
OCT 4

The Orange County ARC will hold its hamfest and auction on October 4, from 9 a.m. to 3 p.m., at John S. Burke Catholic High School. Admission is $3. Tables $7, tailgating $3. License exams begin at 9 a.m. Talk-in on 146.76 and 146.52. For more information, call Bob WB2ENA at (201)-767-6698.

CINCINNATI CLUB 50TH
OCT 4

The Greater Cincinnati ARA invites all amateurs to work club station W8DZ to help them celebrate 50 years of service. Frequencies just inside the General phone bands and 45 kHz up on CW will be used. For a facsimile stock certificate of one share of Cincinnati, send QSL, address label, and a 22-cent stamp to W8GS, 620 Woodsway Drive, Loveland OH 45140.

WARRINGTON PA
OCT 4–5

The Pack Rats (Mt. Airy VHF ARC) will hold the 10th annual Mid-Atlantic VHF Conference on October 4 at the Warrington Motor Lodge, and the 15th annual Pack Rat Hamarama on October 5 at the Bucks County Drive-In Theater, Rte. 611, Warrington, Pennsylvania. Admission to the flea market is $5 per carload, with selling spaces $6 each. The gate will open at 6 a.m. Bring your own tables. Advance registration for the conference is $4. Send payment to Hamarama '86, PO Box 311, Southampton PA 18966, or call Pat Cawthorne WB3DNI at (215)-672-5289.

SPRINGFIELD OH
OCT 5

The Independent Radio Association will hold its 4th annual Springfield, Ohio, Hamfest and Computer Expo on October 5, from 8 a.m. to 4 p.m., at Clark County Fairgrounds, a quarter mile west of the intersection of I-70 and Ohio Rte. 41 (Exit 59). Admission is $3, $2 in advance, children under 12 free. Tables are $7, $6 in advance. Talk-in on 145.45. For advance reservations, write the Independent Radio Association, PO Box 523, Springfield OH 45501, or call Steve KA8QCS at (513)-882-6521.

ST. JOSEPH MI
OCT 5

The Blossomland ARA will hold its Blossomland Blast on October 5. For more information, write "Blast," PO Box 175, St. Joseph MI 49085.

COLUMBIA MD
OCT 5

The Columbia ARA will hold its 10th annual hamfest on October 5, from 8 a.m. to 3:30 p.m., at the Howard County Fairgrounds (15 miles west of Baltimore just off I-70 on Rte. 144, one mile west of Rte. 32). Admission is $3, XYLs and children free. Tables are $7 if payment is received by Sept. 30, $8 afterwards. Outdoor tailgating $3, indoor tailgating $6. Talk-in on 147.735/.135 or 146.52. For table reservations and information, contact Mike Vore W3CCV, 9098 Lambskin Lane, Columbia MD 21045; (301)-992-4953.

YONKERS NY
OCT 5

The Yonkers ARC will sponsor the Yonkers Electronics Fair and Flea Market on October 5, from 9 a.m. to 4 p.m., at the Yonkers Municipal Parking Garage (corner of Nepperhan Avenue and New Main Street). Admission is $3, children under 12 free. Sellers, $7 per parking space. Talk-in on 146.865, 440.150, and 146.52. For further information, contact YARC, 53 Haywood Street, Yonkers NY 10704; (914)-969-1053.

ROME GA
OCT 5

The Coosa Valley ARC will hold the Rome, Georgia, Hamfest on October 5 at the Rome Civic Center on GA 20, across from Shoney's. Admission is free. Inside tables $5, outside spaces $2. Exams begin at 8 a.m. For more information, contact Bobbie Carol Waller KA4DXU, 24 Wellington Way, SE Rome GA 30161; (404)-235-5417.

ALFALFA COUNTY OK
OCT 5

The Salt Plains ARC will hold its annual Ham Social on October 5 at Salt Plains Lake in northern Alfalfa County, Oklahoma. Talk-in on 147.30/.90.

SATELLITES

Number 27 on your Feedback card

USING THE AO-10 PREDICTIONS

Apogee predictions for the month of October are provided for three sections of the United States: Washington, D.C.; Denver, Colorado; and Los Angeles, California. Times are in UTC and apogee in this case is mean anomaly 128 rounded to the nearest whole hour. Use the chart as a guide in aiming your antenna, then fine-tune the azimuth and elevation values to peak the satellite's beacon signal. If you require more accurate orbital predictions, contact AMSAT at PO Box 27, Washington DC 20044.

AMSAT-OSCAR 10 APOGEE PREDICTIONS
October 1986

		WASH		DENVER		LA	
DAY	TIME	AZ	EL	AZ	EL	AZ	EL
2	1030	242	3	219	20	207	31
3	0949	235	10	209	24	195	34
4	0908	227	16	199	27	183	36
5	0827	219	21	188	29	171	35
6	0746	209	25	176	30	159	33
7	0705	199	29	165	29	148	30
8	0624	188	31	154	26	138	25
9	0543	176	31	144	22	130	19
10	0502	164	30	135	17	122	12
11	0421	153	27	127	12	116	5
12	0340	143	23	120	6		
13	0259	134	18	113	0		
14	0218	126	12				
15	0137	119	6				
16	1236					246	5
17	1155			247	0	239	12
18	1114			241	6	232	19
19	1033			234	13	224	25
20	0952	248	0	226	18	215	30
21	0911	241	7	217	24	204	35
22	0831	234	14	207	28	192	37
23	0750	226	19	196	31	179	38
24	0709	217	25	184	32	166	37
25	0628	207	29	172	32	154	35
26	0547	196	32	160	30	143	30
27	0506	184	34	149	27	134	25
28	0425	171	33	140	23	125	18
29	0344	160	31	131	17	118	12
30	0303	149	28	123	11	112	4
31	0222	139	24	116	5		

CORRECTIONS

In the QRP column in the July, 1986, issue (p. 83): The table on the left shows "Lengths of quarter-wavelength ground radial wires"; the table on the right shows "Resonant lengths of wire."

An error crept into Tom Miller's universal frequency display, "What You See Is Where You're At: Part II," in the May, 1986, issue. Please add an extra divide-by-ten stage as shown in Fig. 1.

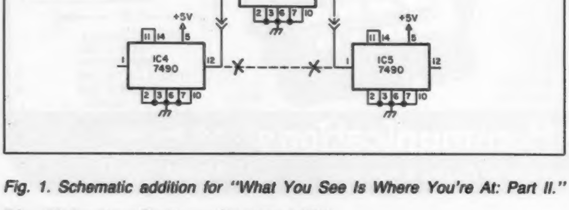

Fig. 1. Schematic addition for "What You See Is Where You're At: Part II."

Send inquiries to Gary Gerber KB0HH, 511 S. Lincoln, Anthony KS 67003; (405)-842-5076.

ROCK HILL SC
OCT 5

The York County ARS will hold the Rock Hill Hamfest on October 5, beginning at 7 a.m., at Joslyn Park on Lake Wylie, in Rock Hill, South Carolina. Pre-registration is $3, $4 at the gate. Talk-in on 146.43/147.03. For more information, contact J. George Trunk N4MCJ, 1158 Wendy Road, Rock Hill SC 29730; (803)-327-4344.

VIRGINIA BEACH ARC 25TH
OCT 5–6

The Virginia Beach ARC invites all hams to help celebrate its 25th anniversary by contacting club station WA4TGF on October 5–6. Operation will be on the following frequencies, ±5 kHz: CW—3.540, 7.040, 14.040, 21.040, and 28.040; SSB—3.890, 7.240, 14.250, 21.340, and 28.560. To receive a special 8 x 10 QSL certificate, send a 9 x 12 envelope and two first-class stamps to R. C. Brown, VBARC, 4821 Rosecroft Street, Virginia Beach VA 23464.

WASECA MN
OCT 11

The Viking ARS will hold its 16th annual swapfest at the Waseca High School on Saturday, October 11. Doors open at 8 a.m. ARRL VEC testing, walk-ins only. Talk-in on .34/.94. Contact VARS, PO Box 3, Waseca MN 56093.

COLUMBUS EVENTS
OCT 11–12

The Columbus ARA will hold the Fourth Annual Columbus Day Special Event on October 11–12 as a triple salute to explorer Christopher Columbus, the city of Columbus, Ohio, and amateur radio worldwide. CARA club station W8TO will operate as a citywide special-event station. For a complete list of rules, write to Amateur Radio Station W8TO, Attn. Special Event Coordinator, 280 East Broad Street, Columbus OH 43215.

IKE B'DAY
OCT 11–12

The Texoma ARC will operate special-event station K5GQD from Denison, Texas, birthplace of President Dwight D. Eisenhower, to commemorate the 96th anniversary of his birth. Operation will be from 1400 UTC October 11 until 2400 UTC October 12 on SSB in the General-class portions of the 2-, 10-, 15-, 20-, 40-, and 75-meter bands. For an 8-1/2 x 11 certificate, send a QSL and a large SASE to K5GQD, 1303 E. Richards, Sherman TX 75090.

MEMPHIS TN
OCT 11–12

The Mid-South ARA and allied clubs will hold their annual hamfest at a new location this year, at the Shelby County Agricenter, from 8 a.m. to 5 p.m. on October 11 and from 9 a.m. to 4 p.m. on October 12. Directions: Poplar Ave. to Germantown (Germantown Road), north about 6 miles; or take Exit 13 on I-240 (Walnut Grove) and go east. Fleamarket spaces are $6 each per day, tables provided. Non-ham XYLs and children admitted free. Exams will begin at 9 a.m. on Saturday. Talk-in on .28/.88 or .22/.82. For further information, contact Clayton Elam K4FZJ, 28 North Cooper, Memphis TN; (901)-274-4418 (days) or (901)-743-6714 (nights).

WICHITA KS
OCT 11–12

The Kansas ARRL Convention will be held October 11–12 at the Holiday Inn Plaza, 250 W. Douglas, Wichita KS 67202. The convention opens at 9 a.m. both days. $5 pre-registration, $6 at the door, non-amateurs $3. VE exams given. Talk-in on 146.82. W0SOE is the official talk-in station. For more information, contact Kansas ARRL Convention, Clarence Reid K0BHJ, 1520 W. 16th, Wichita KS 67203.

WARNER ROBINS GA
OCT 11–12

The Central Georgia ARC will sponsor the 8th annual Central Georgia Hamfest and the 1986 Georgia State ARRL Convention on October 11–12, from 8 a.m. to 5 p.m. on Saturday and from 8 a.m. to 3 p.m. on Sunday, at the Warner Robins Recreation Center, 800 Watson Blvd., Warner Robins, Georgia. Admission is free. Plenty of tailgate space. Exams given both days at 9 a.m. Talk-in on 146.25/.85. For more information, write to CGARC, PO Box 2585, Warner Robins GA 31099.

TEXAS HERITAGE
OCT 11–18

A mobile special-event station (using callsigns N5IWA, N5OUK, and KA5JHT) will be operating on October 11–18 in conjunction with the Texas Heritage Excursion Rallye (T.H.E. Rallye), which is a Texas Sesquicentennial activity sponsored by the Pro-Texas Foundation and the Sports Car Club of America. Stations will be operated on the Novice segments of the 40- and 80-meter bands and on the General segments of the 20-, 40-, and 80-meter bands. For a commemorative QSL, send a QSL and an SASE to Hal Collins KA5JHT, PO Box 473068, Garland TX 75047-3068.

LIMA OH
OCT 12

The Northern Ohio ARC will hold its annual Allen County Hamfest on October 12, at Allen County Fairgrounds in Lima, Ohio, located one mile east of I-75, Exit 125A, on State Rte. 309 or 117. Tickets are $3 in advance or $3.50 at the door. $6 for a full table, $3.50 for a half table. Talk-in on 146.67 and 146.52. Exams given. For more information or reservations, send an SASE to NOARC, Box 211, Lima OH 45802.

PUMPKIN FESTIVAL
OCT 15–18

The Teays ARC will operate special-event station WB8PPH on October 15–18 to commemorate the annual Circleville Pumpkin Festival. Operation will be in the General phone bands for the following times: October 15, 1700–0100 UTC; October 16–18, 1500–0100 UTC. For a commemorative certificate, send a QSL and an SASE to Len Campbell WB8PPH, 8951 State Route 188, Circleville OH 43113.

NBS 85TH
OCT 17–18

The Bureau Radio Amateur Signal Society (NBS BRASS) will operate special-event station K3AA from 2100–0200 UTC on October 17 and from 1300–0100 UTC on October 18, from the grounds of the National Bureau of Standards, in celebration of the 85th anniversary of the founding of the Bureau. Frequencies: phone—3.900, 7.235, 14.235, and 21.360; CW—3.535, 3.710, 7.035, 7.110, 14.035, 21.035, and 21.110; packet—20m. For a commemorative certificate, send a large SASE to NBS BRASS, National Bureau of Standards, Gaithersburg MD 20899.

SYRACUSE NY
OCT 18

The Radio Amateurs of Greater Syracuse will hold its 31st hamfest on October 18, from 9 a.m. to 5 p.m., in the Arts and Home Mansion at the New York State Fairgrounds, just two miles east of Thruway Exit 39 on Rte. 690. Admission is $4, children under 12 free. Tailgating $3 per car. Indoor flea market $6 per table. Talk-in on 146.31/.91 and 147.90/.30. Exams begin at 12 noon. For more information, call Ed Swiatlowski WA2URK at (315)-487-3417 or Viv Douglas WA2PUU at (315)-469-0590, or write RAGS, PO Box 88, Liverpool NY 13088.

JAMBOREE ON THE AIR
OCT 18–19

The World Bureau of the World Organization of the Scout Movement will sponsor Jamboree On The Air, an annual scouting/ham radio event, from 0001 local time on October 18 to 2400 local time on October 19. Look for K2BSA, the BSA headquarters station in Ft. Worth, Texas, and for HB9S, the World Scout headquarters in Switzerland, and for other special callsigns from many countries. Frequencies: CW—3.590, 7.030, 14.070, 21.140, and 28.190; voice—3.940, 7.290, 14.290, 21.360, and 28.990; packet, RTTY, SSTV, and ATV on usual frequencies. Check the Novice frequencies. K2BSA will be operating on OSCAR 10. Postcard-sized certificates are available free to all participants and may be ordered beforehand for presentation during JOTA. Send requests to Jamboree on the Air Certificates,

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A complete kit to build the switched capacitor filter featured on page 46 is available from Valley Electronics. This kit version includes the "optional" capacitor and resistor for additional gain, a headphone jack, and a filter in/filter out switch. The circuit board is double-sided, and the entire unit is housed in an attractive cabinet with wood-grain end panels.

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ST. CHARLES IL
OCT 18–19

The Fox River Radio League will sponsor an ARRL Central Division Convention as part of its Hamtastic Weekend on October 18–19, from 10 a.m. to 4 p.m on Saturday and from 9 a.m. to 2 p.m. on Sunday, at the new Norris Sports Center, just off Rte. 64 in St. Charles, Illinois, 35 miles west of Chicago. Tickets good for both days are $3 in advance or $4 at the door. Exams will be given. Talk-in on 144.870/145.470 and 144.610/145.210. For advance tickets or for information on tables or exams, contact Bill Heimann WD9WE, 837 Lebanon Street, Aurora IL 60505; (312)-859-1171. Include an SASE.

ST. PETERSBURG FL
OCT 18–19

The Florida Gulf Coast Amateur Radio Council presents the ARRL South Florida Section Suncoast Convention on October 18–19, from 9 a.m. to 4 p.m., at the National Guard Armory in St. Petersburg, Florida. The convention hotel is the Holiday Inn I-275. Admission is $4 in advance, $5 at the door. Swap tables are $12 for both days. Flea-market area and all exhibits are indoors. For further information, write to FGCARC, PO Box 157, Clearwater FL 33517.

LAKE TEXOMA OK
OCT 24–26

The Texoma Hamarama Association will hold its Hamarama '86 on October 24–26 at Lake Texoma Lodge on Catfish Bay, in Lake Texoma, Oklahoma, near Kingston. Exams will be given. For additional information, contact Texoma Hamarama Association, PO Box 610892, DFW Airport TX 75261.

POQUETANUCK CT
OCT 25

The Tri-City ARC will hold its fourth annual auction on October 25, beginning at 10 a.m., at the St. James Parish Hall, Poquetanuck, Connecticut, 1-1/2 miles east of Rte. 12 on Rte. 2A (south of Norwich). Free admission. Talk-in on 146.52. Call WA2RYU at (203)-464-6555 for further information.

BARBECUE FESTIVAL
OCT 25

The Healing Springs Mtn. VHF Society will operate special-event station WD4BBQ on October 25, from 1300–2100 UTC, for the 3rd annual Lexington Barbecue Festival. Operation will be on 40m, 20m, and 15m. Phone: 25 kHz up from the edge of the General-class band. Novice band: 7.125 as time permits. Also area 2m repeaters. For a special Bar-B-QSL, send an SASE to Healing Springs Mtn. VHF Society, PO Box 41, Lexington NC 27293-0041.

LONDON ONT
OCT 26

The London ARC will hold a flea market on October 26 from 9 a.m. to 2 p.m. Admission is $2, $3 for vendors. Talk-in on 147.060. For more information, contact London ARC, c/o John Pedersen VE3MGR, PO Box 82, Stn. B, London, Ontario N6A 4V3 Canada; 472-6506 after 6 p.m.

FRAMINGHAM MA
OCT 26

The Framingham ARA will hold its annual fall flea market and exams on October 26, beginning at 10 a.m., at the Framingham, Massachusetts, Civic League building, 214 Concord Street (Rte. 126). Admission is $2. Tables $10 (includes one free admission). Talk-in on .75/.15. Pre-registration required for tables and exams. Contact Jon Weiner K1VVC, 52 Overlook Drive, Framingham MA 01701; (617)-877-7166.

KALAMAZOO MI
OCT 26

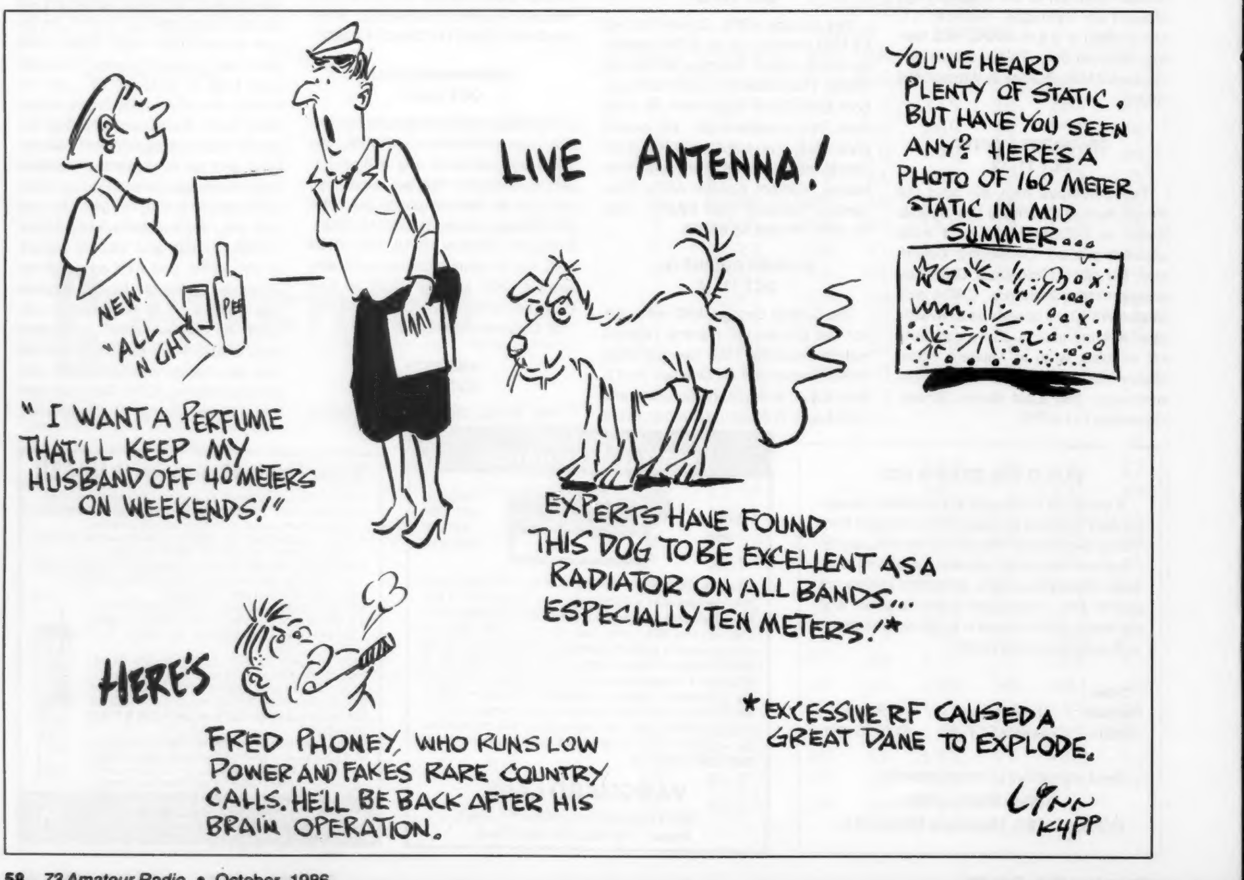
The Kalamazoo ARC will hold its 4th annual Hamfest and Radio Swap on October 26, from 9 a.m. to 2 p.m., at the Kalamazoo County Fairgrounds, 2900 Lake Street, Kalamazoo, Michigan (halfway between Chicago and Detroit). Admission is $2 in advance, $2.50 at the door. Talk-in on 147.00+. 8-foot table space $6. For reservations, contact Ken KA8RUA, 2825 Lake Street, Kalamazoo MI 49001; (616)-345-4609 (work). Exams given. For information, contact Al Nelson K8OQB, 10603 Cora Drive, Portage MI 49081; (616)-323-3812.

MARION OH
OCT 26

The Marion ARC will hold its 12th annual Heart of Ohio Ham Fiesta on October 26, from 8 a.m. to 4 p.m., at the Marion County Fairgrounds Coliseum. Tickets are $3 in advance, $4 at the door. Tables $5. Talk-in on 146.52 or 147.90/.30. For more information, tickets, or tables, contact Ed Margraff KD8OC, 1989 Weiss Avenue, Marion OH 43302; (614)-382-2608.

LAS VEGAS NV
NOV 7–8

HAM/WEST and the ARRL Nevada State Convention, will be held all day November 7 and 8 at the Hacienda Hotel in Las Vegas, Nevada. Advance registration is $12 before October 24 or $15 at the door. For all info, see the ad in this issue or contact HAM/WEST, PO Box 19675, Las Vegas NV 89132; (702)-361-3331.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See September 1984 issue of *73* for TIMEX/RTTY article

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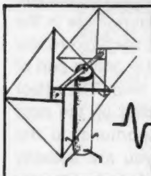

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HOW FAST IS 2400?

Well, instead of being on the air, I'm sitting here talking to you. It's not entirely your fault, though, since there are several other things I'm behind on. Besides, I still haven't cleaned the dirt out of the key that I/O the dog is playing with on page 84 of the August issue, and that's the only key I own. For the record, I/O remains uncertain about the future of CW, and dug the key up again.

Speaking of the big *73* packet issue, as I write this, I haven't seen it yet. I hope you liked it, and I hope you filled out the bingo card to tell us which articles you liked most and sent it in so I'll have an idea of what you want to see more (or less) of in the way of packet.

I learned several things while working on that issue, the foremost being never to be specific about the launch date of a satellite in a publication with a longer than two-day lead time. While the packet issue was in final processing, the Ariane program lost a flight (V18) and the AMSAT Phase 3C launch (V21) has been postponed. There is, as of yet, no new date, and I wouldn't mention it now even if there were.

As of this month, the packet column contains some information at a slightly higher than beginner level. On a scale of 1 to 10, 10 being esoteric ivory-tower stuff, I'll try to keep it in the 3 to 5 region for a while. That's the way my mail has been leaning, and the August issue should have satisfied the very introductory level needs for some time to come. Think of this as the beginner's guide to intermediate packet topics. It's been shown that it is easier learning Morse code if you take it at a reasonable speed to start with. That's what Wayne says, and he's never been wrong before, right? So I'll toss in some "reasonable difficulty" packet topics to help you get your packet IQ raised quickly, and you'll have a month to rest up in between. This month's topics are: "Is 2400 baud really twice as fast as 1200?" and some of the issues raised at the June Digital Committee meeting.

Dallas Hamvention

I attended the Dallas Hamvention in May. The Dallas gang always puts on a good show, and this year was no exception. They take the time to do it right, and spend some of the proceeds to fly in the best guest speakers (blush). They have a lot of vendors and a large swap meet.

This year, several packet manufacturing companies were present. A 2400-bps packet-radio modem was demonstrated at this show, although it was not yet available for purchase. The question heard most often was, "Is 2400-bps packet really twice as fast as 1200-bps packet?" The sad but true answer is, "No, not by a long shot."

The reason for that is transceiver turnaround time—and I'll use that as a lead-in to something a few letters have asked me to discuss: TXDELAY and DWAIT. Sit back and I'll tell you all about it.

Packet's Black Hole

In the pre-digital days, no one really cared how long it took between the time the other guy's hand gripped the microphone on one radio and when the words started coming out of the speaker on another radio. As long as no delay was noticeable to the human senses, the process was fast enough. There was no "black hole" turnaround time. Even if the process took a half second or a bit more, the most that would be missed would be part of a syllable. And since there is usually a long interval of time between the hand clench and the unclench, the percentage of syllables lost in any one transmission is vanishingly small. If the radios take 1/2 second to turn on and the total transmission is 60 seconds, the time wasted is 0.83%.

Then came packet, where half a second is time enough for 60 characters to be missed at 1200 baud. If a packet takes .6 seconds to send and the turn-on time is .5 seconds, 45% of the time is wasted. Fortunately, most radios are faster than .5 seconds, but some are not much faster.

In packet, we are very interested in the total turnaround time. A radio has three timing parameters of interest here: the time it takes between when the push-to-talk (PTT) line is asserted and when stable rf is being emitted (key-up time), the time it takes between when the PTT line is released and when the radio is ready to receive again (un-key time), and the time it takes the receiver to lock up and unsquelch (RX start time). For the purposes of this discussion, we'll define turnaround time as un-key time plus receive time.

It is your radio's turnaround time that usually will determine the minimum time that the station you are talking to must wait before it starts to send data. This is because the sum of your un-key and receive time is usually larger than the other station's key-up time. One turnaround-time interval must pass between the end of a frame that you transmit and the start of a frame the other station transmits. This relationship is shown in Fig. 1.

The other station does not have a direct adjustment parameter for your turnaround time; it has only one for its key-up time. This is called TXDELAY. Most hams set a TXDELAY that is far larger than what is actually needed for their own key-up time. This is fortunate; otherwise, many packets would be lost due to the turnaround-time black hole. Note that each station in the local-area net must set a TXDELAY that is long enough to make up for the slowest turnaround-time station in the net. Otherwise, the slow station would have no one to talk to because its receiver would never be ready in time to hear the acknowledgments sent in response to packets it had transmitted.

So far,. we've seen one place where time consumed in sending packets is unrelated to the amount of data sent or the speed it is sent at. A second delay is DWAIT. The DWAIT parameter adds additional wait time between when the frequency goes clear and when your station will try to go on the air. There are two reasons DWAIT is used. The first is to leave a hole in the channel utilization so digipeaters can get a word in edgewise. The second is to add delay so that BBS systems won't grab a disproportionate amount of channel time. DWAIT was discussed in detail in the August issue. DWAIT and TXDELAY are shown in Fig. 2.

Figs. 1 and 2 are similar, and, in fact, it is usually the DWAIT parameter at the other station that makes up the extra time that allows your station to get ready to receive another packet. In Fig. 2, the hole left by DWAIT is meant to be filled by the start of a digipeated packet. For best results, DWAIT should be set to the amount of time it takes for the digipeater to key-up—its true TXDELAY value. For BBS stations, DWAIT should be increased.

There are actually a few more complicating factors; one of these days I'll sit down and write a book about it. But for now, this should give you an understanding of some of the non-data speed-related delays in packet.

Is 2400 Twice 1200?

We started this discussion to show why 2400-bps packet is not twice as fast as 1200-bps packet. Armed with the knowledge in the previous section, we can now see why: Data speed is only a part of the total packet time. The effect gained by speeding up the data rate is only proportional to the length of time you are actually sending data. Let's look at the actual time it takes to exchange a packet.

As of the spring of 1986, most of the data on the packet channels comes from store-and-forward message systems. The most popular systems, written by W0RLI and WA7MBL, send out packets based on the length of the line of the message being sent. There seems to be a disagreement on the best number of packets to send out in a single transmission (MAXFRAME); some use one, others two or three. For this discussion, we'll assume that two are sent.

Many stations keep the default

```
-------+                               +----------
your   |                               | his
packet |                               | packet
-------+                               +----------

       +---- your turnaround time -----+

       +--unkey-----+
                     +--rx start time--+
```

Fig. 1. Turnaround time and packet timing, not to scale.

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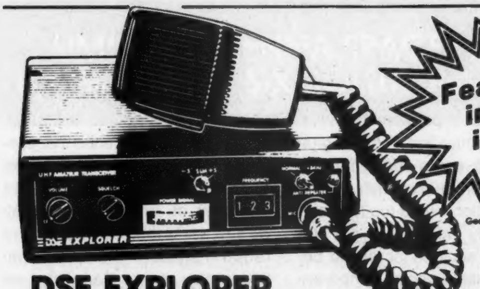

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TXDELAY setting of 30. On the TNC-2, this means the length of time to wait for the transmitter to turn on is 300 milliseconds (ms). WB6YMH and I ran a test this afternoon to see how small we could make it. My receiver (an IC-251) has a turnaround time of 220 ms. We determined this by connecting our stations together, and then setting WB6YMH's TXD to 1. I sent a frame, and WB6YMH's TNC station acknowledged it. He increased his TXDELAY until my TNC heard the ack. He had to set TXD to 22 before my station got turned around in time to hear the ack. (By the way, I'd be interested in getting reports on the turnaround time of other radios.)

For the first example, I'll use actual parameters from a local BBS and its user TNCs to show the average improvement to be expected. Assume there are two IC-251s with TXDELAY on a TNC-2 set to 22. The transaction to be measured is two packets containing 72 data characters sent in one transmission, and an ack frame sent in a second transmission. DWAIT is 30 on the BBS, and the default is 16 on the user TNC. Length of a single data frame is 576 data bits plus 152 overhead bits—addresses, CRC (Cyclic Redundancy Check), for examples. The ack frame is 144 bits long. The total data sent is 1,600 bits. The total non-data delay is 900 ms. The total transaction time at 1200 bps is 2.23 seconds; at 2400 bps it is 1.57 seconds. Thus, 2400 bps is an improvement of only 1.4X, or 42%.

You can get closer to twice as fast if you are doing a point-to-point bulk file transfer and if you retune your TNC accordingly. Assume a file transfer, with the file sent four frames at a time, 250 bytes per frame. The other parameters remain the same, and the improvement is 1.8X, or 80%.

Note that even if the data rate is increased to 9600 bps, the improvement is only 2.1X, or 110%. So how do we get faster? By decreasing the turnaround time. In discussions with those who know radios, I'm told that 10-ms turnaround times are easy and that 1 ms is obtainable with a little care. Assuming a 10-ms turnaround in the first example with no data rate increase, the transaction time improves 1.65X, or 65%. Then increasing the data rate to 2400 gets an additional 1.98X improvement.

```
--------+                               +-----------
his     |                               | your
packet  |                               | packet
--------+                               +-----------

        +--dwait-----+
                      +---- txdelay ----+
```

Fig. 2. DWAIT and TXDELAY.

It should now be obvious that what we need are faster *radios*, not just faster modems. There are at least two manufacturers with a project in the works to do just that, i.e., build an rf modem with both a higher data rate and a fast turnaround time. The improvement given by a 9600-baud radio with a 10-ms turnaround time over the 1200-bps, TXDELAY-22 example given above is 11.7X, or more than 1,000%. They may cost more than just adding a TNC to your existing radio, but an 11X improvement is worth the greater cost.

Determining just how much more it's worth will cause the manufacturers some sleepless nights, I'm sure. I saw a prototype of a 4800-baud fast-turnaround rf modem at Dayton, and, as of this writing, hints are being dropped that a 9600-baud rf modem will show up at the San Diego convention in the fall. In the meantime, if you do a lot of point-to-point file transfers, the 80% improvement offered by the current 2400-baud modems in that mode may suit your needs.

An unfortunate side effect of turnaround time and the TXDELAY adjustment is that the turnaround delay of *your* radio should determine the TXDELAY setting of the *other* TNC. There is no standard way of allowing your TNC to suggest a setting to the other TNC . . . yet. Just such a capability came up at the June meeting of the ARRL Ad Hoc Committee on Digital Communications, which is the closest thing we have to an AX.25 standards organization. And that, friends, is the segue into our next topic.

ARRL Digital Committee

Back in my first column, I said the ARRL was doing good things for packet. One is sponsoring and publishing the proceedings of the yearly amateur Networking Conferences, and a second is sponsoring the Digital Committee. This group meets at least twice a year (and has just had its June meeting) to discuss technical issues and to handle various sociopolitical problems that the local League members and offshore Leagues bring up. Officially, the committee is an advisory group to the ARRL board to help the ARRL make decisions on what it wants to do in packet matters. It also has become the semiofficial AX.25 standards committee. Anyone may attend these meetings; one of them each year is held at the Networking Conference.

I'm out of room for this month as it is, so I can only mention a few of the topics discussed. (I'll talk about some of them in detail at a later date.) The major topics were:

•HF frequency utilization. Much concern over the use of HF message-forwarding frequencies and congestion has been expressed to ARRL board members, and they passed it down to us. We gathered information and listed the issues and concerns, and are currently waiting for input from a group of five "Big Gun" HF BBS stations before making final recommendations.

•Automatic operation on HF. The ARRL board executive committee wanted to do a limited test of unattended HF packet with 15 stations participating. The Digital Committee, again consulting the HF BBS community, determined that 15 stations were too few, and is currently working to get the number of stations increased before an official Special Temporary Authority request is filed with the FCC.

•Changes to AX.25. GLB proposed that AX.25 be modified to allow a TNC to poll another TNC to see if any special, manufacturer-specific features are present, and if so to make use of those features. The committee agreed with the desire to add this capability, but disagreed with the proposed implementation strategy. We determined that a new frame called an XID frame would be more suitable. This frame would be sent before the actual connection was begun, and could be used both to request a list of features from a TNC and to state a list of available features. One use to which this capability could be put would be to announce the turnaround time of the station so that the other TNC could adjust its TXDELAY to an optimum value. New features to AX.25 cannot be added lightly; since there are now (as of June) approximately 18,000 AX.25 TNCs in existence, new features must not cause older TNCs to be unusable. Terry Fox WB4JFI is to work up a specific proposal for circulation to TNC software and hardware users and to the general packet-user community.

•Changes to Part 97. The committee has begun work to define major changes to Part 97 to permit future development of digital technology in the amateur bands. We want to have major agreement throughout the digital community before we submit a proposal to the ARRL board to have them petition the FCC. Look for these preliminary proposals in the short-lead-time publications. I'll be discussing why such steps are necessary in a future column.

•Growth. We discussed the Novice Enhancement proposal made by the ARRL, and while everyone had a minor point or two where a change in the proposal was desired, we all agreed that it was a step in the right direction. We agreed that digital was amateur radio's growth mode right now, and if amateur radio itself is to get back on the growth track, digital would be a major participant. We also tentatively agreed to think about proposing to discuss at some future date the possibility of looking into a limited, entry-level digital license that possibly could contain a clause that might be construed as having the attributes of, er, ahem, er, shall we say, a less than complete set of requirements in the traditional telegraphy sense. Seriously, we want to see if it is possible to define a digital license that the general amateur population will accept. This is not a task we've been set to do by the ARRL, and it may never get to the stage where we'll propose it to the ARRL, but since the term "digital license" keeps popping up in various places, it makes sense that the digital community determine what such a thing might be.

We're way out of space for this month. While I've been working on this column, WB6YMH has been using me as a guinea pig for a binary file transfer program that uses the TNC's transparent mode. It looks good, and we may talk about file transfer here next month. Or, we may have something completely different. You'd better check in and see.■

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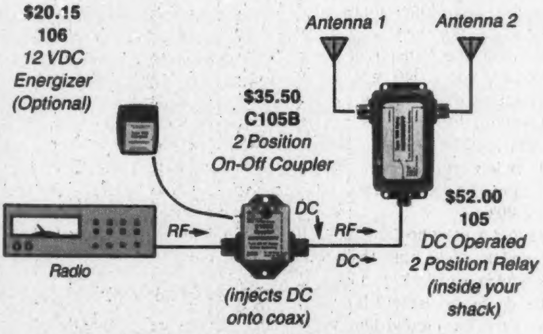

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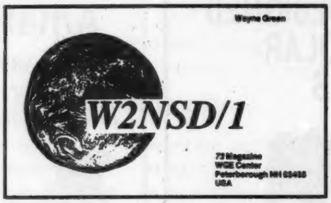

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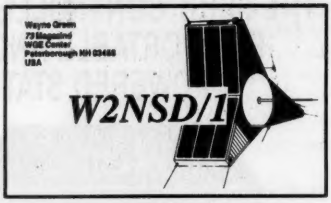

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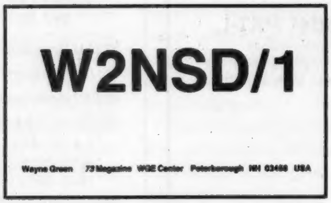
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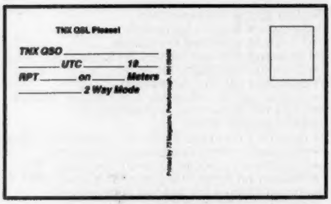

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"What's in it for me?" comes the cry from our faithful readers. Besides the knowledge that you're helping us find out what you like (and don't like), we'll draw one Feedback card each month and award the lucky winner a free one-year subscription (or extension) to *73*.

To save some money on stamps, why not fill out the Reader Service card, the Product Report card, and the Feedback card and put them in an envelope. Toss in a damning or praising letter to the editor while you're at it. You can also enter your QSL in our QSL of the Month contest. All for the low, low price of 22 cents!

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3	Shoestring Shortwave
4	The End Of The Rope
5	A Simple Way to Measure SSB PEP
6	Microwave Building Blocks: The I-f Amplifier
7	The DXer's SCF
8	One Band, One Transistor
9	Your Dinner Last Night
10	Pappy Linn K4PP Cartoons
11	Review: Dick Smith 440 Mobile Transceiver
12	Review: Heathkit HOA-5404-1 Pan Adapter
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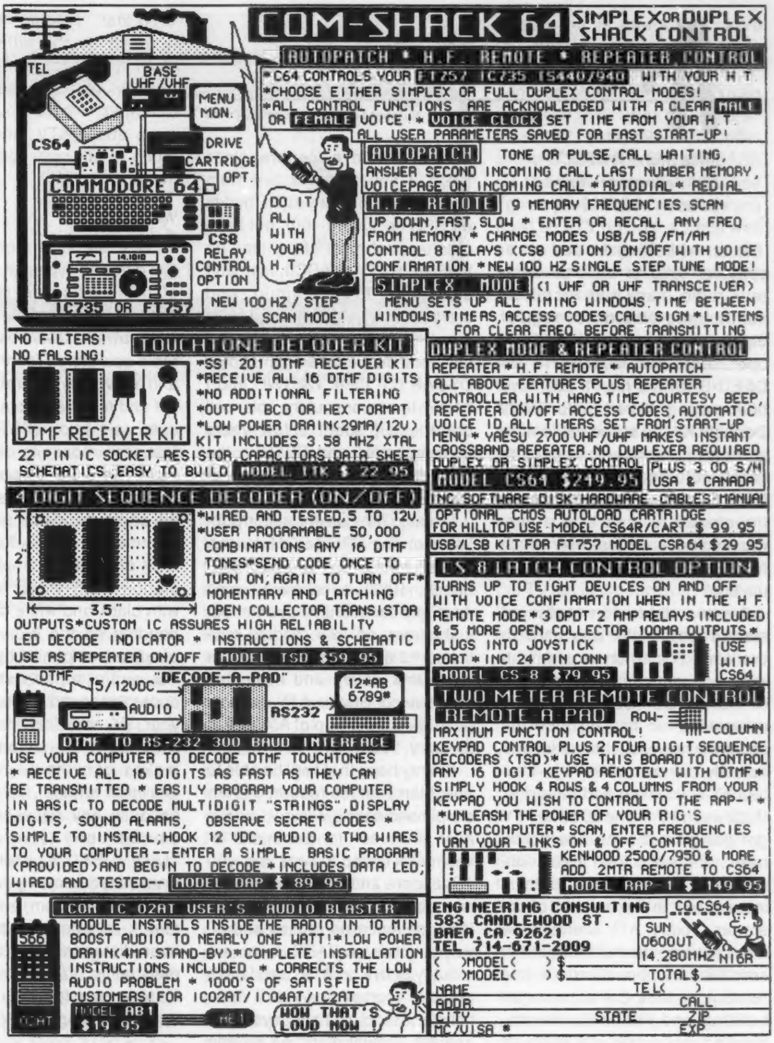

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ATV

Number 14 on your Feedback card

Mike Stone WB0QCD
804 Jefferson Avenue
Lowden IA 52255

It is refreshing to see a respected, leading national amateur radio magazine recruiting contributing editors for regular coverage of specialized mode operations. Yes, WAYNE IS INDEED BACK as his *73* ads have been saying. When Editor Perry Donham KW1O asked me to write a monthly amateur television (ATV) column for them, I was flattered and couldn't turn down the chance to preach to a captive audience on just how much fun amateur television can be in the 80s!

Amateur television really got started unofficially way back in the early 30s when experimenters and commercial employees of RCA, NBC, CBS, and other companies ran first tests on the shocking new visual medium and actually did so under their amateur FCC licenses and callsigns. But it wasn't until the 50s that ATV got going on a bona fide hobby basis, and since then it has continued to grow steadily both in interest and in the number of operators. Today, ATV is one of the most exciting modes available in specialized communications and remains an area that encourages building and real experimentation and, of course, is a whole lot of fun!

First a little background on myself. I have been a licensed amateur for about 12 years now and currently hold a General-class ticket. I have been active from time to time on nearly all HF bands on SSB (including 160), but have of late spent most of my time on VHF/HF RTTY or ASCII, fast- and slow-scan TV, facsimile, and more recently VHF/HF packet radio. I am solely responsible and take total blame for shutting down OSCAR 6 (I think W0RWC and I here in Iowa wore out the solar cell batteries). I spent a few years passing traffic and SSTV in the U.S. Navy/Marine Corps MARS (NNN0AWF).

I'm also the current editor/publisher of *The SPEC-COM Journal* (known as *A5 ATV Magazine* until March, 1985), a relatively small specialty communications periodical (strong on ATV modes) published 10 times per year (see our ad in this issue), and I founded The United States ATV Society (an organized group of ATVers) in January, 1983.

It is my hope that I will be able to enlighten you, the reader, on how simple and easy it is to get "on the ATV airwaves" for a minimal investment. I need to hear from you *73* readers and will try to answer as much mail directly as possible. Have patience on replies and always include an SASE. If you are already active on ATV, send me a photo of yourself and your TV station setup and a bit about yourself and the activity going on around you. Some of this material may also be selectively cross-published in *SPEC-COM* from time to time.

To start, I would like to briefly touch on the different types of ATV, how to get started, how to build or purchase gear and antennas, where you can read more about ATV, and just how much it will cost you to get on the air.

What Is ATV?

Let's talk for a moment about the different types of ATV. Most of the public and many thousands of licensed amateurs are NOT aware that licensed ham radio operators (Technician class and above) can operate full transmit and receive TV stations! Fast-scan television (FSTV)—called fast scan mostly to distinguish it from the type of picture sent on slow-scan TV—uses exactly the same standards as American Commercial NTSC TV, i.e., 525 lines of captured amplitude modulation (AM) video information with black and white or color (depending on the type of camera used), accompanied by a 4.5-MHz FM audio subcarrier that produces the sound that comes out of your TV set. This match to the American Television standard makes conversion to amateur television an ideal, low-cost option because any household TV set can be used to receive ATV! "Live" UHF-TV pictures can be transmitted from any camera over the airwaves from one person's shack to another—sometimes over distances of several hundred miles. VCRs have become quite a popular tool for storing and recording FSTV programming and CQ calling and testing sequences.

Slow-scan TV is the still-frame, slide-show type of image that you have perhaps seen coming from the Voyager spacecraft vehicles where the picture starts painting from the top of the screen and downward in a slow, but steady display pattern. Slow-scan TV signals are really video pictures converted into audio tones sent through your radio's microphone circuit, picked up by the other person's receiver and decoding box, and reconverted into a video picture on the tube again. Since the tones sent and received are in audio form, they can be recorded on any standard audio cassette or reel-type recorder for later replays. The old days of green or yellow P7 image-storing tubes and blurry, fading pictures are long gone and have been replaced by quality, high-resolution b/w or full color images.

Unlike fast-scan TV, which is limited to local area ground-wave propagation, SSTV can travel thousands of miles—from California to South Africa and back again—on the HF bands, all in just a few seconds of transmission time! (A General license and above is required at this time.) 14.230 MHz on the 20-meter band and 28.680 MHz on the 10-meter band are the two most used "hot spots" for this type of activity.

Tune in on your HF receiver at just about any time of day or night and listen for the operators

Photo A. Hi, from Mike WB0QCD.

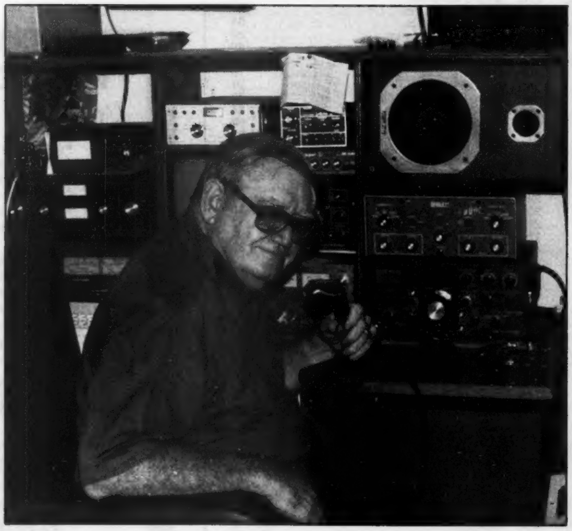

Photo B. Dave Guthrie (formerly 5N0DOG) operating RTTY/SSB/SSTV from Lagos, Nigeria, in March, 1980.

talking about their video pictures and SSTV gear. Most SSTV operators will stay in one small frequency area of operation so their shrill tones won't annoy others nearby not interested in the fascinating TV picture mode. A good time to catch these fellas and gals is on a Saturday, late in the morning and in the early afternoon (1800 UTC) on 14.230 MHz as they check into established SSTV nets conducted by Brooks Kendall W1JKF and Don Miller W9NTP. They have a lot of fun "relaying" each other's pictures from one part of the country to the other for all to see!

One other form of ATV that is gaining popularity is similar in standards to SSTV, but is usually classed in a separate category. I am speaking now of facsimile TV. FAX for many years was a paper-printing picture and information mode only. But now, with today's technology, it, too, has worked its way into small IC chips and color video monitors.

While all three forms of ATV have been crossed in transmissions, FSTV and SSTV are generally thought of as true ATV. The slower, but more interesting FAX mode of visual communications is now being covered in Dr. Ralph E. Taggart WB8DQT's column, WEATHERSAT, beginning with this issue. Any mention of the FAX mode in MY future columns will be of a very limited basis. Check out Ralph's column for the latest in what's happening on that medium.

Which Mode Should I Get Into?

Which type of ATV is right for you? Maybe you would like to try them all but want to take on only one at a time. Perhaps asking yourself a few basic questions about your current interests might help to steer you in the right direction. Do you have patience and do you like to tinker, solder, build, experiment, and operate the VHF/UHF bands more than the HF frequencies? Do you already have a video tape recorder and a camera of some type, or do you really enjoy the challenge that UHF operation demands? Then fast-scan TV is for you.

If you like to work DX, work all states, conduct long, general ragchews, and have a better than average hobby spendable income, then slow-scan TV will be quite enjoyable for you. Both ATV modes can be done cheaply or expensively. I will steer you and give you the choice of both directions in my future columns. For this month's column, I will briefly discuss getting started in fast-scan TV, as it is the newest and most misunderstood mode to most radio amateurs.

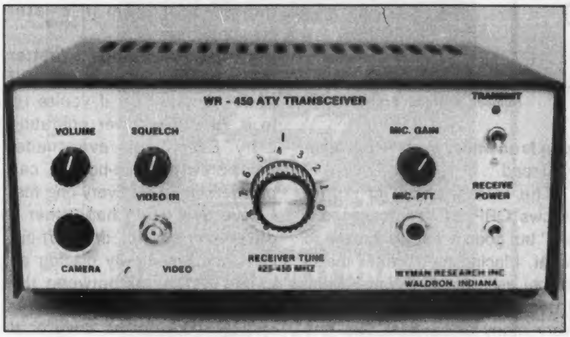

Photo C. Wyman Reseach WR-450 ATV transceiver.

And Now a Brief Word From Our Sponsor

If you are serious about getting started on FSTV, I recommend *SPEC-COM*'s ATV manual, *EVERYTHING YOU ALWAYS WANTED TO KNOW ABOUT ATV *but were afraid to ask*. It is 112 pages and 15 chapters of jam-packed information from the history of television to ATV repeaters, groups, and clubs in the United States. This manual has a lot of money- and time-saving tips, construction diagrams, projects, article references, and commercial advertising that will answer a lot of your questions about ATV. Even SSTVers should have this book. It sells for $9.95 ppd. Write for Book #100 to the address at the end of the next paragraph.

While I have the store open, any of you who would like to receive a "free" sample issue of *SPEC-COM*, just send $1 to help offset the postage and I will put a recent issue in the mail to you along with subscription information (see our ad in this issue). Order the above book, and I'll include the issue in the same envelope and pay the postage for you (you must ask for the sample issue to be included). Both items are published and available from The SPEC-COM Communications Group, PO Box H-73, Lowden IA 52255. End of commercial.

Back To Our Movie

The biggest problem in getting on fast-scan TV is finding someone else to see your pictures. Maybe you are lucky and you already live in or near an area that has ATV going. Most major cities in the United States have some level of UHF ATV activity. Drop me a line with your location, and I will give you the names and callsigns of amateurs around you already operating the mode, what antenna polarization they are operating, and what frequencies they are sending their pictures and talking on. If you are in an area where no ATV activity exists, you have the distinction of becoming a real pioneer! For that, you'll need a buddy to get on the air with. 439.25 MHz is the nationally recognized calling frequency for FSTV operation.

To get started using ATV, you need a small UHF TV-type antenna, some good low-loss coaxial cable, a downconverter, and a good working (preferably state-of-the-art) TV set. That's it! To send ATV pictures and sound, you simply add a transmitter, a microphone, and sound subcarrier generator. A complete low-power ATV transceiver can be purchased "ready to go" for less than $300. If you would like to build it yourself, you can save even more money!

There are several companies here in the United States making quality, low-cost, commercial-type ATV transmitters, receivers, and related equipment. The largest and oldest by far is one owned by Tom W6ORG and Mary Ann O'Hara WB6YSS. Their company is called P.C. Electronics (2522 S. Paxson Lane, Arcadia CA 91006; (818)-447-4565), and they, too, have regular ads in *73*. The basic ATV "receive only" downconverter board that is completely tuned and built (ready for cabinet housing) costs $49 (TVC-2). An 80-mW transmitter runs $89 delivered (a 10-Watt version is $179). A complete 1-Watt PEP "all-featured" FSTV transceiver is offered for $299 (TC-70-1).

In the Midwest, Don W9NTP and Sue Miller W9YL of Wyman Reserach (RR#1 Box 95, Waldron IN 46182; (317)-525-6452) offer similar equipment. Send an SASE for their catalogs. Wyman's line "gives you a choice" and lets you build an ATV rig from scratch with a bare board, supplied parts, and extensive documentation at even greater savings.

Communication Concepts, Inc., (2648 North Aragon Avenue, Dayton OH 45420) has a neat little ATV-1 receive board kit for $34.95. Want to buy your own parts? The board is available for $10, the manual for $5.

TV sets can also be modified to receive channel 13-1/2 ATV signals and, when preamped, can be as sensitive as purchased or built downconverters. Since the TV set is the receiver, most of the expense has been taken out of getting on the visual mode. A lot of ATVers like to home-brew their own small UHF TV antennas, and they work just dandy. KLM and the more popular English-made Jaybeams are used by most for the best performance, especially over long distances. P.C. is a good source for the KLM antennas and John Beanland G3BVU/W1 of Spectrum International (PO Box 1084SC, Concord MA 01742) is the U.S. distributor for Jaybeams.

Good low-loss coaxial cable is essential, such as Saxson's 8285, Belden's 8214, or preferably their better 9913 line. High-power amplifiers of 50, 100, or more Watts can be purchased from Mirage and other sources or home built to extend the operating range of your fast-scan TV signals. It is not uncommon here in the Midwest to work distances of more than 250–500 miles several times in the year during band enhancements. During Field Day weekend, from Iowa, I made two 2-ways with P2 pictures with stations in Cincinnati, Ohio!

Well, gang, I have tried to give you a fast crash course on what ATV is, how to get started, and where to begin to find sources for equipment. Later, I'll go more deeply into the specifics of these modes and how they are being used on the air today, along with a list of ATV groups and repeater systems around the country. Stick with me and *73*, and I will soon have you doing the "nightly news" from your anchor desk. Goodnight, Walter.■

QRP

Number 24 on your Feedback card

Michael Bryce WB8VGE
2225 Mayflower NW
Massillon OH 44646

I guess that I should get several things out in the open. Number one, I don't want anyone to think that I'm out to lower the power limit on the amateur bands. I like the idea of telling a newcomer in my shack that I can run up to 1.5 kilowatts PEP output. When I try to explain to that new Novice that he can work the world on a "Watt or two," he looks at me as if I'm not wrapped too tight.

If you enjoy running an amplifier, hey, that's fine with me! In fact, if it were not for the QRO (high-power guys) on the other end, life would be very dull for me. There are times when "the other guy's" skill, patience, and expertise make all the difference in making the low-powered QSO work. If that still makes you upset, then I guess you can join the "Hate Mike Bryce Club." Send all requests to my wife, Lynnette, president of the club, or to vice-president Terry Russ N8ATZ. It should be noted that Terry is under a six-month suspension for buying me a Coke at a hamfest. I run QRP because I *like* to, not because I must.

I imagine there are several different types of people who will read this column. Number one would be those interested in QRP operation. Second, those who heard about it and would like more dope on the subject. Third, the guy who's curious about different hobbies within amateur radio. And finally, the guy who grabs this issue on the way to the men's room. I hope to include something for everyone.

QRP

I'm not one to break tradition, so we might as well start at the beginning. Just what is this QRP stuff anyway? I'm sure you have all heard about it before, but may not know exactly what it's all about. Well, operating QRP means running low power. So the first question is: "How much power is QRP anyway?" That's like my three-year-old son asking, "How high is up?" The answer to both questions depends on whom you talk to or what you read.

The international Q signal shows QRP as "decrease power," but does not say decrease to what. Placing a "?" after the Q signal asks the question, "Shall I decrease power?" I doubt that very many of us hear that one on the air! The FCC has a regulation on the books, Part 97.67, that goes like this: "Notwithstanding the provisions of paragraph (a) of this section, amateur stations shall use the minimum amount of transmitter power necessary to carry out the desired communications."

Hmmm, sounds kind of open to me. In real life it's not followed too much. As an example, let's say you're running a kilowatt on 20-meter SSB. If you reduce your power to 400 Watts and still are S9 on the other end, you can say you're QRP. I don't think 400 Watts is QRP, do you? But what if you're running 10 Watts and are S9—you're still illegal until you reduce power to, say, 2 Watts. So the answer to the question? Well, the term QRP is relative. I would be QRO at 20 Watts if you're running 5 Watts, and you'll be QRO to someone running 900 mW.

> *"If you're running 10 Watts and are S9 you're still illegal until you reduce power to, say, 2 Watts."*

Even the ARRL is gray in this area. For example, the League defines QRP as 10 Watts input, 5 Watts output, but does not recognize power levels under 1 Watt as being very, very low power. (In some circles, it's known as QRPp; to others, milliwatting.) As for me, I consider anything under 5 Watts *output* as QRP—no matter what the input power is. This is also the power limit defined by the QRP ARCI (more about them in a later column).

I hope that brings a better understanding to you about QRP power levels. Now if you're up to it, give low-power operation a try. Every radio ever made, home-brew or store-bought, can be used on QRP. Every one that I have ever seen had either a drive-level control or an rf-out level adjustment. By placing an in-line wattmeter between the antennna and the transmitter and by reducing the drive or rf level, you can put the output power anywhere you want. If this is your first attempt, try running about 20 or so Watts output. This will ensure a good number of contacts and start your blood moving. Keep reducing your rf power to 2 or 3 Watts, and then start enjoying the true sport of QRP!

After a while, you may notice it does not make much sense to run a 100-Watt radio throttled down to 2 Watts. There are what I guess you can call QRP transceivers on the market. Without a doubt, Ten-Tec's famous "Argonaut" series transceivers are world-class. The Argonaut's big brother, the Argosy, sports a low-power position switch for power output of less than 5 Watts. Hardly a red-blooded QRPer has ever been born who has not at least operated one of these radios. Ten-Tec also sold the Century 21, a high-powered QRP transceiver if you will. The Century runs about 35 Watts output, and can be reduced in output via a front-panel control. The Century 21 was discontinued a few years ago, and the Century 22 took its place. It also runs about 30 Watts output and sports a variable rf drive control.

Next in line comes the Heath HW series. Heath sold about 10,000 HW-7s and somewhere in the neighborhood of 15,000 HW-8s before they were taken off the market. Heath's new HW-9 is selling very well. While the HW-7 was a bit of a dog, the HW-8 remains a very strong QRP contender. There are many other makers of transmitters/receivers and transceivers. Some are now history, and others are very new to the marketplace.

There is one more way to get on the air without the need of lighting off that big rig. You can try your hand at building a transmitter of your own. There are some very simple one- or two-transistor transmitters out there, but I would recommend that you first get your feet wet by working a few stations with the QRO transceiver at reduced power. There have been reams of paper consumed describing different transmitters to build. You will never know the satisfaction of making contacts with something you have built with your own hands until you try. It's not that hard, and it's a lot of fun!

No matter what amount of power you're used to running, the antenna makes the difference between an empty log book and a mailbox full of QSL cards. Even more than ever, a good antenna system is a must. It pays to use the best. Put a good dipole up high and in the clear. Use some type of gain antenna on 20, 15, and 10 meters. Monitor the propagation. Use the propagation as a tool. Listen to the bands. If someone is running a kW on 40 meters in Ohio and he is only S3, with you in New York, then you may as well go watch reruns of "Star Trek" as to try QRP that night.

If you have yourself all geared-up and ready to go, where do you look to find some good QRP action? Depends on the bands, but listen for low-power stations on 80 meters at 3.560 and 3.540 MHz. On 40 meters at 7.040, 7.030, and 7.060 MHz. On 20 meters at 14.060 MHz. On 15 meters at 21.060 MHz. And finally on 10 meters at 28.060 MHz. What's this, you're not into CW? Then try SSB on 80 meters at 3.985 MHz, 40 meters at 7.285 MHz, 20 meters at 14.285 MHz, 15 meters at 21.385 MHz, and 10 meters at 28.885 MHz.

On the Hook

Next time, who knows? Perhaps some contesting with low power. If you like the column, then please tear out the Feedback card and send it in. Wayne Green reads these columns at night, so I hope that he gets to mine before his warm milk and cookies. I know he would like to hear from you about how I'm doing. And secondly, I need the money! So drop the 22 cents for a good cause. I would also like to hear from you, the readers, about what you would like to see, or not to see, here in the QRP column. I have a big mailbox and a friendly mailman (mailperson?), so drop me a card or letter, and we'll see what happens.■

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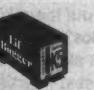

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NEITHER SNOW, NOR RAIN . . .

The column this month is dedicated to our local letter carrier, who is recovering from injuries suffered while bringing me the last (heavy) bag of fan mail. I shall try to wade through as much of this as I can this month.

John Gunsett KI4VP of Manassas, Virginia, asks whatever happened to Macrotronics, Inc., of Turlock, California, which manufactured the Terminall unit. He has upgraded his computer setup from a TRS-80 Model I to a Model 4 in the Model III mode, and would like to upgrade the Terminall unit as well. Well, John, I have no information on that company. The only thing in the files for the TRS-80 Model I/III/4 is a program written by Clifton J. Turner, Jr. WB5KCQ in Alexandria, Louisiana, which several amateurs have found comprehensive. Does anyone out there know about Macrotronics? Let me know, and I will pass along the information to the masses.

Greetings to Robert Davis, of Gillette, Wyoming, another of our loyal readers. I hope the information sent out is of use. Kenji Sugimoto JG1GWL/KE6QX in Setagaya, Tokyo, Japan, also sends along his regards. I hope to hear you on RTTY soon, too, Ken. Ditto to Gary Allen, of Mt. Carmel, Tennessee, and Nathan Leichty, of Grand Rapids, Michigan.

Serge Cuvilly HH2C of Port Au Prince, Haiti, would like to interface a recently purchased HAL DS-3000 KSR terminal with an Epson RX-80 printer for a hard copy. Well, Serge, I do not have any information on the DS-3000, but if it has an RS-232 modem connector as does the DS-3100, you may be able to use that serial output to feed the printer, assuming your printer has a serial interface. Anyone out there done this one yet? Let me know, and I'll print what I can find out to help us all.

All of the comments about stray rf, going one way or another within the ham shack, prompted a response from J. Fred Bergsma VE3CLS of Stratford, Ontario. Fred relates that, rather than having problems with rf in the shack exciting his computer, he seems to have more problems with rf from the computer bothering the HF and VHF equipment. The VHF antenna, he states, is in close proximity to the computer, which accounts for a large part of the interference—although he believes that a more typical installation might still be affected.

Fred lives in an apartment, and is having his share of problems installing a good ground system. Nonetheless, he feels that his computer, an IBM PC, would make a good RTTY station, if only he could solve this one problem.

Well, Fred, if you are able to obtain enough of a ground for the ham station to work, I doubt if that is the source of the problem. Having the VHF antenna near the computer certainly may be a problem, though, as radiated rf, originating in the computer, may be picked up by the antenna, partially rectified (detected) by the VHF radio, and re-radiated to create spurious signals all over the spectrum.

Depending on just what kind of computer you are running—IBM brand, other brand, or brandless clone—shielding within the computer cabinet may be adequate, borderline, or nonexistent—not necessarily in that order! If you can shield the box and any cables running outside of the main unit, this may help as well. Keep plugging along, and let me know how things interface.

Speaking of interfacing (sorry), Gary G. Flechtner WB8HLI of Tiffin, Ohio, has a Commodore Plus/4 computer that he would like to put onto RTTY. He states that his queries to several Commodore Users Groups, as well as inquiries to other magazines, have been fruitless. Surely one of our readership must have a solution for Gary's problem, no? Drop me a line, and I will print the information for all to benefit!

Russ Butterworth WA6TJS of Corona del Mar, California, has just acquired an Apple //c, with an added CP/M card, and all the accessories, and would like to get onto amateur RTTY, as well as receive weather and news on CW, receive and possibly send TELEX via European commercial stations, and get onto packet radio. He wonders just what is needed to accomplish at least all of this.

Well, to begin with, amateur RTTY is easy. Just use any of the RTTY programs we have covered here in the past. Well, kind of easy. You see, most, if not all, of these have been directed at the Apple][or Apple //e computers. A few months ago we dealt with the difficulties of interfacing the Apple //c on RTTY given its apparent lack of game ports or the like. I have received no answers on this one, and this reported difficulty may influence the rest of your task.

So, while there have been many programs published to run CW on Apples of various species, I am at a loss for interfacing the //c at this point in time. Packet is not so much of a problem, however, as this normally requires an ASCII terminal program of sorts, with an external terminal node controller, which itself contains most of the "smarts." I hope more will be available for the Apple //c, and don't doubt that it will. As it becomes available, where else do you think you will see it, but right here?

Up in Winchester, Massachusetts, Bob Thompson N1CIH is trying to put his TRS-80 Model I onto RTTY. Among other things, he has looked in vain for the function generator detailed here a few months back in the "single-chip RTTY" circuits. Well, Bob, although Radio Shack has omitted these chips from their current catalog, a look around at a few other parts suppliers (they advertise widely) will turn up the XR-2206 and other chips to boot. You may even find them on the wall of a local parts emporium, safely encased in plastic bubbles.

The information presented on the Model 100 touched a responsive chord in Lou Graue K8TT of Bowling Green, Ohio. Lou has written several RTTY programs, and offers a possible solution to the Label Line question on the Model 100 program.

Adding the following line to the program will label the keys:

```
176 KEY1,"60WM":KEY2,
"66WM":KEY3,"75WM":KEY4,"
100":KEY5,"T – R":KEY6,"
NL":KEY7,"LPRT"
```

In order to return to default, line 300 should be changed to read:

```
300 CALL 23164,0,23366:CALL
27795:MENU
```

And, if you want the label line to come up at the beginning, add the line:

```
177 CALL 17064
```

Lou adds that you cannot toggle the label line while in "receive" but you can while in "transmit." Thanks for the help, Lou. I am sure that the many Model 100 users thank you as well.

Can anyone help Agust Bjarnason TF3OM from Iceland? He is only one of many users of Macintosh computers that yearn for the thrills only RTTY can deliver. So far, none of my feelers for a MacRTTY program have been answered. I somehow can't believe that at least a couple of dozen hams aren't running a Mac on RTTY—am I that misguided?

Yes, that fabled list of reprints is still around, and remains available for a little old self-addressed, stamped envelope. For those of you who may have come in late, this list is a recap and revision of some of the material in earlier years of this column. Feel free to ask for the list; you just may see something that interests you.

I continue to hang out on several national BBSs, as well, as time and expense permit. E-mail addressed to user number 75036,2501 on CompuServe or to MARCWA3AJR on Delphi stands a better than even chance of reaching me. I try to reply to E-mail as soon as possible after I receive it; certainly faster than written mail. After all, I am already at the terminal when I receive it! Anyway, letters are, of course, welcome. Enclose that self-addressed, stamped envelope with those letter questions if you desire a personal response, as well.

And now, a tease. For several months, I have been hearing from owners of TRS-80 Color Computers that what they are looking for is a disk-based RTTY program, with full features. As I write this last paragraph, guess what just showed up here at the station? Let me look this over and play with it for awhile. The result should hold a great big find for CoCoNuts in a future column. Don't worry, I won't forget the rest of you. How could I? You tell me that *73*'s most read pages are right here—in RTTY Loop!■

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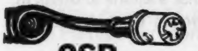

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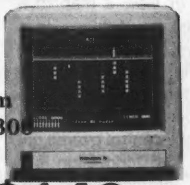

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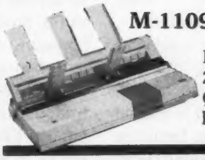

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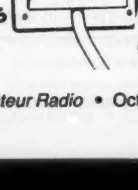

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DON'T TELL A MAN NOT TO DREAM

If Milt Jensen N5IA had not believed that dreams could be made into reality, the Zia Connection would never have been born. What is the Zia Connection, you ask? It's many things.

Technically speaking, it is simply a bunch of repeaters that have been interconnected to let hams in one town talk to hams in another and to those on the road in between. Obviously, there are some who look at the Zia Connection as a marvel of modern technology. It can be seen as proof that open, wide-area, intercommunity repeater linking on a full-time basis can be accomplished even over long distances. Most important, though, it proves that amateurs involved in VHF FM need not be shackled in their communications abilities by the designated coverage of their favorite repeater: Through cooperative effort it is possible, as the telephone company has said for years, to reach out and touch someone. The Zia Connection is all this and a lot more.

For those of you who have not guessed by now, the Zia Connection is a wide-area, open, interconnected repeater network. To be more specific, it covers an area that stretches a shade under 1,000 miles across the southwestern United States. The actual east-to-west distance is about 600 miles, but that does not count some of the north-south tributaries that have been built into the system to serve communities like Tucson, Arizona; Albuquerque, New Mexico; and El Paso, Texas. To say that the Zia Connection is the world's largest open repeater is not to make an overstatement. One must either use the system or view a map of it to understand its vastness. In a magazine we can bring you the latter: See Fig. 1.

Unlike other linking systems that limit access to a select few or that stringently control overall utilization, the Zia Connection is a totally open, interconnected system available to any licensed amateur wishing to use it, on a 24-hour-a-day basis. The only times that portions of the system are not available to all users are when technical difficulties arise or when some local disaster situation takes precedence. Thankfully, these instances are few and far between.

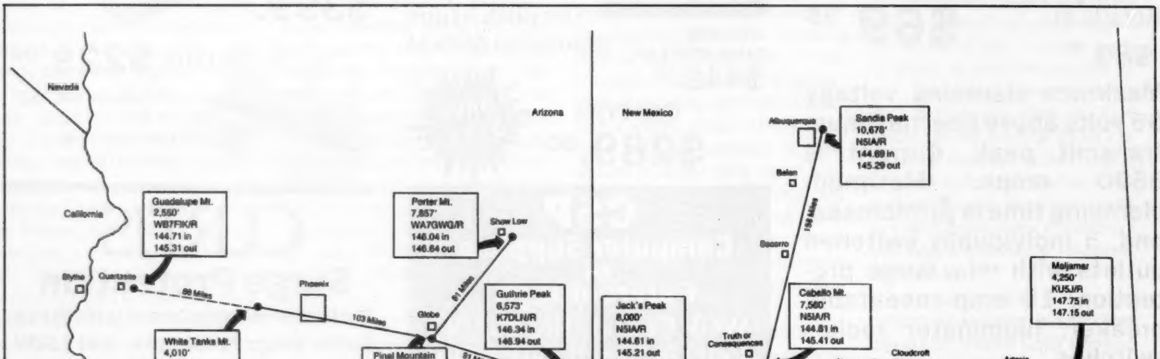
Using the system is no different from using any system. It operates in full-duplex mode, which means that signals go both ways over the link at the same time, not unlike a conventional telephone. Operationally, this is very desirable as it allows instant break-in. It also prevents doubling with another station when users have the capability to operate their own stations in the full-duplex mode, as well. In most cases this means having a pair of radios on separate antennas—one talking on a Zia Connection repeater input and the other on that system's output. Full duplex is not necessary, but it does tend to make operating sessions very pleasant for those using the system.

According to N5IA, working stations through the Zia Connection is no different from working them through a single repeater. Each repeater in the system has its own timeout setting, but all repeaters are matched as closely as possible. This way if you time out one of the local ports, you do not cause the entire interconnected system to crash. It remains up and running; only you go away until the timer reset occurs. This is accomplished by not timing the link transmitters to the local repeaters or vice versa.

The only identifier heard when using the Zia Connection is that of the local repeater port. The automatic IDs of the link transmitters are notched out and not repeated on the talk-around or talk-back. When you drop your carrier after a transmission, most ports will "Courtesy Beep Tone" after about a one-second delay. This is a reminder to allow time for other stations to break in, as they would on a local-area system.

The drop-out time from one end of the system to the other is in the order of 200 milliseconds, so it is almost impossible to tell which repeater is inputting to the system. Unlike other interconnected repeater systems, you will never hear a series of squelch tails after you unkey. The same is true on key-up. The pickup time is about 300 milliseconds for the overall system, and Milt suggests that you make it a habit to wait for about a half-second after keying your transmitter before you start talking.

Most of the repeaters within the Zia Connection (see list in Table 1) are privately owned and funded. It is a tribute to the small group of people who dreamed it up that a system of this magnitude has developed a wide enough following to exist with purely voluntary support. Obviously, the setup initially involved a tremendous outlay of capital, and thereafter its operation involved considerable expense (site rental fees, power, equipment maintenance) and effort—laborious trips up the sides


Nevada
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New Mexico
California
Texas
MEXICO
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2,550'
WB7FIK/R
144.71 in
145.31 out
Porter Mt.
7,857'
WA7GWG/R
146.04 in
146.64 out
Show Low
Blythe
Quartzsite
88 Miles
Phoenix
103 Miles
Globe
91 Miles
Guthrie Peak
6,573'
K7DLN/R
146.34 in
146.94 out
White Tanks Mt.
4,010'
W7EX/R
146.10 in
146.70 out
Pinal Mountain
7,848'
WA7ZNY/R
144.65 in
145.25 out
91 Miles
Safford
140 Miles
Mount Lemmon
9,157'
KD7QK/R
147.75 in
147.15 out
Tucson
Albuquerque
Sandia Peak
10,678'
N5IA/R
144.69 in
145.29 out
Belen
150 Miles
Socorro
Jack's Peak
8,000'
N5IA/R
144.81 in
145.21 out
Truth or Consequences
Cabello Mt.
7,560'
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144.81 in
145.41 out
Silver City
58 Miles
74 Miles
Hatch
Alamogordo
Cloudcroft
85 Miles
Maljamar
4,250'
KU5J/R
147.75 in
147.15 out
Artesia
117 Miles
Benson Ridge
9,666'
N5IA/R
144.63 in
145.23 out
Las Cruces
Comanche Peak
5,220'
KC5EJ/R
144.73 in
145.33 out
61 Miles
El Paso
Juarez
In Service
Under Construction
Remote Base Input

Fig. 1. The Zia Connection repeater system.

of multi-kilofoot mountains, for example.

It exists because it provides a service that nothing else could, not even a 75-meter SSB point-to-point system. The Zia Connection is a living monument to the greatness that we amateurs can achieve. Amateurs involved in VHF FM repeater operations need not have their entire world revolve around the 50-mile radius of a local repeater. Rather, horizons can be expanded: With a simple $200 HT, you can communicate a good part of the way across the continent.

For more information about the Zia Connection, send an SASE to Milt Jensen N5IA, Rte. 1 Box 156, Duncan AZ 85534.

The Super Councils Are Coming, the Super Councils Are Coming

Do the names Mid-America Repeater Council, Southeastern Repeater Association, or Tri-State Amateur Repeater Council mean anything to you? If you are involved in repeater frequency coordination, they may. But if you are just an average Joe Ham, these names probably mean very little. You should know about them anyway, because their very existence can and will eventually have an effect on your day-to-day, on-the-air operation. You see, these are the first three "Repeater Super Councils." They are voluntary coordination groups that have stepped beyond the boundaries of a given state or local area to become recognized regional leaders. In my view, they are the vanguard of things to come.

By far the largest and most successful of the Super Councils is the CVRA-SERA (the Carolina Virginia Repeater Association-South Eastern Repeater Association). Started 15 years ago to handle the emerging repeater coordination needs of the states of North Carolina, South Carolina, and Virginia, the organization never had any intention of expanding. However, as time progressed, amateurs in adjoining states watched the way the CVRA-SERA handled coordination, emphasizing technical excellence rather than politics. Pleased with what they saw, one after another of the neighboring states petitioned CVRA-SERA for membership. As a result, today the SERA oversees coordination of more than 1,200 repeaters in seven states. They do this through autonomously elected Area Directors and Area Vice Directors, who represent the will of the majority of a given state.

Site	Equipment Owner	On Line
Mt. Lemmon	John Vanza AK7Z	8/82
Pinal Peak	George Lewis W7SBZ and Joe Montierth WA7ZNY	3/86
Porter Mt.	Kachina Radio Club	5/85
White Tanks Mt.	Ken Simpson WB7DRD	10/83
Guadalupe Mt.	Milt Jensen N5IA and Cactus Radio Club	–
Jack's Peak	Milt Jensen N5IA	7/82
Caballo Mt.		1/83
Benson Ridge		9/82
Sandia Peak		5/85
Comanche Peak	Rick Fultz KC5EJ	12/83
Guthrie Peak	Eastern Arizona ARS	8/82
Maljamar	Bob Perkins KU5J	9/84

Table 1. Who owns what and where.

The SERA itself serves mainly as an umbrella organization, setting technical standards and band plans, settling inter-area disputes, and publishing what I can only consider the very best of newsletters put out by a repeater council. Did I say "newsletter"? Magazine would be a better term, since four times a year that's exactly what the SERA mails out to its members and other interested parties. Their May, 1986, issue was 50 pages and semi-hard-covered. Topics included lightning protection, the possible effect Novice enhancement will have on repeater operation, and a lot of information on the happenings within the organization itself. It also has paid advertising from some of the top names in the amateur supply industry, as well as numerous major amateur conventions. It's a magazine that rivals the "big four" in both quality and appearance. Not bad for what amounts to a small group of volunteers. In fact, the CVRA-SERA is doing such a good job that they now have become the standard of excellence to emulate.

In addition to the Carolinas and Virginia, the organization also oversees coordination matters in West Virginia, Kentucky, Georgia, and Tennessee. Alabama has petitioned the CVRA-SERA to become its 8th district. Not wanting to be accused of plundering the domain of another regional coordination group, however, the CVRA-SERA has wisely placed that application on hold until the political climate in Alabama is more favorable. With tempers flaring between pro-15-kHz and pro-20-kHz factions, the CVRA-SERA does not feel it should get involved in the political unrest of that area. They can only be successful if they have 100% support, and right now that is impossible in Alabama.

Another coordinating group that had no intention of ever becoming a Super Council is TSARC, the Tri-State Repeater Council in the Northeast. They came into being a few years after the old Northeast Repeater Association died, and took on the task of bringing order onto 2 meters. This task was accomplished in the late 70s under very able leadership. It wasn't easy since several years had elapsed between the time that NERA went bye-bye and when TSARC appeared.

In the early 80s, with Steve Mendelsohn WA2DHF (now ARRL Hudson Division Vice Director) at their helm, TSARC turned its attention to developing other bands and providing protected spectrum for emerging modes including packet radio. In fact, they were among the first to recognize that packet might well be the boom of the 80s and 90s, as FM repeaters had been the boom of the late 60s and 70s.

TSARC was also the first repeater council to recognize that continued viability in repeater operation meant that rules were needed to ensure orderly growth. The repeater deregulation of the mid-70s had brought with it a wild and uncontrolled expansion in the number of systems coming onto the air, many of which served no other purpose than the owner's ego fulfillment. The result of TSARC's interest in solving the uncontrolled growth problem manifested itself in their supplying much of the input utilized by the FCC in its formulation of the proposals contained in P.R. Docket 85-22, also known as the Repeater Rules Rewrite of 1985–1986. (See the July, 1986, Looking West for more details on this regulatory change.)

While the CVRA-SERA has become a Super Council for reasons of geographic representation, TSARC has attained this position based on its abilities in the political arena. They had some minor geographic expansion when the northern tier of Connecticut decided to break away from having their coordination handled by the New England Spectrum Management Association, and opted for TSARC.

Currently, TSARC represents almost 1,000 repeaters operating in the southern portion of New York state, including New York City and Long Island, plus all of New Jersey and Connecticut. Like the CVRA-SERA, they have no eye toward expanding their sphere of influence past these borders, but as with CVRA-SERA, the Tri-State organization is more than willing to lend its expertise to its neighbors if they seek assistance.

Making Use of Repeaters

Our final story this month is about the way FM and repeaters can be used in time of emergency. It's a hard-news story, so I am going to abruptly change my writing style to that used by the Associated Press and United Press International. It's also the "style" used in my *Westlink Report* newsletter, which is where I gleaned this story from.

Amateur radio proved to be the key element in coordinating a five-day firefighting effort and the largest mass evacuation in the history of the United States. This occurred after a freight train derailed near the city of Miamisburg, Ohio, on Tuesday evening, July 8. Miamisburg is located about 25 miles south of Dayton, Ohio, and is the home of the famed former amateur-radio equipment manufacturer, R. L. Drake. The derailment caused a tanker car filled with white phosphorus to rupture. The phosphorus ignited when it came into contact with air, and the ensuing fire formed a toxic cloud that engulfed Miamisburg and an area about 40 miles in circumference.

According to Area District Emergency Coordinator Ron Moorfield W8ICL, amateur radio was called upon to provide common communications channels to all emergency services coming into the area. As has been the case in other incidents in other areas, in Miamisburg, when police and fire crews arrived from other cities, they were not equipped with radio gear capable of communicating on the frequencies assigned to the emergency services in the Miamisburg area. As soon as it was realized that only amateur radio could quickly provide a common radio communications link with Central Dispatch, some 250 area hams were contacted and pressed into service as emergency-service communicators under the area ARES plan.

Working in around-the-clock shifts, amateurs equipped with 2-meter VHF-FM mobile and handheld gear were assigned to ride in all police cruisers and maintain contact to a station at the Miamisburg Central Dispatch office. Other amateurs were stationed at local hospitals and command posts and were assigned to various officials, including Ohio Governor Celleste. In addition, amateurs funneled information between the local weather bureau and the Environmental Protection Agency, which required weather updates every 15 minutes.

Most communication took place using the MOUND Amateur Radio Club's repeaters operating on 147.195 MHz and 145.33 MHz. In addition, a direct link between the on-site Emergency Command Post and the state's Disaster Service Agency in Columbus was established on 145.11 MHz, with amateurs posted at both ends to handle a constant flow of emergency-related traffic.

Moorefield said that due credit should be given to the MOUND Amateur Radio Club, as well as to hams representing approximately 20 different radio clubs that took part in this emergency communications activity. Some operators came from as far away as Cincinnati and Columbus. At any given time, between 90 and 100 hams were on duty, running shifts from 7 to 10 hours, depending on a given activity.

At the height of the crisis on Wednesday evening, the amateurs assisted the police and emergency-service personnel in the evacuation of 50,000 people from the cities of Miamisburg, West Carrollton, Marine City, and sections of Jefferson Township, after it was determined that the toxic smoke from the fire was a definite hazard to public health. About 15,000 of the evacuees were cared for by the Red Cross at evacuation centers, and again it was amateur radio that provided communications between Red Cross headquarters and the shelters.

The fire was finally brought under control early on Saturday, July 10. "We have a lot of tired amateurs," Moorefield told *Westlink Report*, "but they did a fabulous job. They were there on duty, and I can't tell you the praise I have for the cooperation we had between all the amateur radio clubs."

Moorefield noted that in addition to the normal emergency-service communications channels and amateur radio, the only other type of communication was the use of several cellular telephones by the Environmental Protection Agency. Not in evidence, at least to Moorefield, were any 11-meter CB, REACT, or GMRS-equipped groups. This was one of those very rare times when amateur radio was more than just the conveyor of messages. Our service, its members, and the repeaters that they built became a very important part of a gigantic public-service humanitarian effort.

And that's quite a lot for this month from those of us who write the late shift here in Los Angeles.■

WEATHERSAT

Number 29 on your Feedback card

Dr. Ralph E. Taggart WB8DQT
602 S. Jefferson
Mason MI 48854

Welcome to WEATHERSAT, one of *73*'s newest columns, devoted entirely to the subject of weather satellite activities. Most of you are aware of those high-tech "eyes in the sky," if only through the medium of your evening news. What most people are not aware of is the extent of the contribution of "amateurs"—the condescending title initially tagged on experimenters by the professional satellite establishment—in developing low-cost options for the reception and display of weather satellite images!

When the first weather satellites arced into orbit in the early 60s, a weather satellite ground station was an expensive operation that required significant government input. If you had suggested at that time that any school classroom or individual hobbyist could put together an effective station for about the cost of a color TV set, the "experts" would have laughed you all the way to the mental hospital. What they didn't appreciate, of course, was the drive and ingenuity of a host of people with an interest in weather, electronics, or simply the desire to see the Earth from "out there."

Operational weather satellite programs were hardly "off the ground" when Anderson, in a classic article in a 1965 issue of *QST*, showed anyone who was interested how to put together a workable receiver and picture display system. That article launched the "amateur" weather satellite movement and, as years went by and the satellites became more sophisticated, amateur experimentation continued, using the steady advances in electronic technology to more than keep pace with the satellite systems themselves. The result is that there are thousands of small satellite stations out there, displaying pictures from both polar-orbit and geostationary spacecraft.

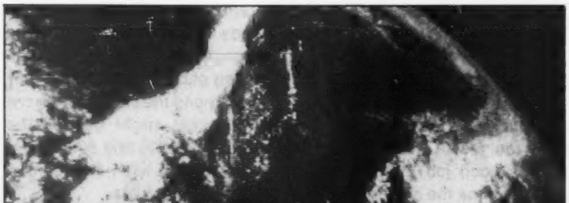

Photo A. NE WEFAX quadrant, imaged by the GOES E geostationary spacecraft and relayed by GOES Central, covering most of the U.S. and Mexico and part of Central America.

In the beginning, all of these satellites were "made in the U.S.A.," but they proved so valuable a tool in forecasting and the development of predictive models that other nations began to orbit their own meteorological spacecraft. The European space organization now operates its METEOSAT spacecraft in geostationary orbit over Africa, and the Soviet Union has a very effective system of operational polar-orbit spacecraft.

No matter where you are in the world, you can have the opportunity to view your region from space four or more times each day. If you are within range of one of the several geostationary spacecraft—and that includes almost everyone in North America, South America, Western Europe, and Africa—you have access to more than 100 pictures per day, covering your own region, with lots of material from elsewhere in the world as well. It will be one of the tasks of WEATHERSAT to keep you informed about all of this action!

It is quite appropriate that *73* should be carrying this column, for this magazine has probably published more articles on weather satellites and facsimile technology than any other major publication in the world. This tradition will continue, but a column like WEATHERSAT provides the opportunity for continuity in coverage that you simply cannot have

CTM

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—J. Trenbick

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—Fred Blechman, K6UGT

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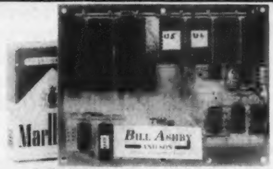

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with individual articles treating specific subjects or projects.

The challenge in running a column of this type is great, due to the breadth of the subject and the wide range of experience in the potential audience. Even the simplest weather satellite station incorporates VHF or microwave antennas, low-noise VHF receivers (with or without a microwave downconverter), and picture display equipment that may run the gamut from simple CRT display terminals through electronic/mechanical facsimile recorders to stand-alone or computer-assisted scan converters. Some involvement with computers, if only to assist in tracking, is inevitable, and that involvement can become quite extensive (although not necessarily expensive) in the case of more advanced projects.

The audience, of course, ranges from beginner to experienced experimenter, but labels like "beginner" can be misleading. Some beginners are competent radio amateurs with a good background in antennas, receivers, and other aspects of electronics. The problem faced by these people is quite different from that faced by individuals starting from scratch in all aspects of the hobby.

Input by Me and Thee

Can a column like WEATHERSAT cover all this territory? If by "cover" you mean an exhaustive treatment of everything, the answer is a simple NO! On the other hand, it is possible to serve as a useful source of information on the satellite systems, new techniques, commercial equipment, and a basic analysis of different areas of importance in setting up and operating a satellite system.

I know my way around this hobby, but in running a column of this sort it is essential that I get connected with every possible source of relevant information. I am taking steps to ensure that I stay current from the governmental end, but it is also necessary to keep in touch with the people who are doing interesting and innovative things—essentially the more experienced end of the reader spectrum.

If you have worked up an interesting weather satellite project, consider doing a full-fledged article—*73* would certainly be interested, as would other publications. The important thing is to get it out so that others can use the information. If the project, idea, tidbit, or whatever is less extensive, then pass it along and I will see that it surfaces in WEATHERSAT. I can accomplish a lot with the column using my own resources, but I can do even better with the active cooperation of other experimenters.

Date	01 October 1986	
Spacecraft	NOAA-6	NOAA-9
Orbit Number	37750	9276
Eq. Crossing Time (UTC)	00:18	00:14
Longitude Asc. Node (Deg. W.)	86	141
Nodal Period (Min.)	101.128	102.085
Frequency (MHz)	137.50	137.62

These orbital parameters are projected two months in advance due to deadline considerations. Accumulated errors due to uncompensated orbital decay and other anomalies result in expectation of errors up to two minutes and possibly as many degrees in terms of the crossing data and possible small changes in the indicated period. Users requiring precision tracking data should rely on more current sources.

Table 1. TIROS/NOAA orbital predict data.

When you are first getting started (and even later), you may come up with questions that just don't seem to be treated in anything you have read. Others may have similar questions. Pass such questions along and I'll make an effort to regularly treat them in the column. For some, I may not have all the answers, but we will get the problem into print and pass along contributions from the readership in later issues.

News Items

One thing that must be kept in mind is the reality of deadlines in the mad world of publications. Some of the things that I would like to do will be limited by such deadlines. This introductory column, for example, was written in July. If you wait for something to happen and then report on it, it will be a bit dated by the time it appears in print. In contrast, should you indulge in a bit of prediction, you may end up looking very current in your coverage or blow it and stand up tall with egg on your face.

Treatment of current "news" items in the weather satellite field is thus obviously limited by deadline considerations. Some of the "news" items must inevitably be a bit dated to the experienced, well-connected satellite station operator, but that person doesn't need the news function that the column will provide. I will include such information for the benefit of those for whom it *will* be news!

Polar-Orbit Predict Data

Orbital prediction data for polar-orbit spacecraft is another area impacted by deadlines. Long-term predictions of satellite passes for spacecraft in relatively low orbits are a complicated business. The complications all involve factors that result in short-term and long-term changes in the geometry of the orbit and its period. Even making allowances for such factors, based on the history of an individual spacecraft, making predictions over a period of several months introduces errors of up to several minutes in equatorial crossing times and of several degrees in the crossing point. These errors are sufficient to make such long-term predictions unsuitable for *precision* tracking, although the information is more than sufficient to know *when* to listen for a particular satellite, particularly if you are using an omnidirectional antenna.

If the predictions went to *73* along with the column manuscript, predict listings would require a three-month projection. The flexibility of the *73* editorial staff permits me to cut this to two months by feeding them figures while the copy is actually in preparation, and this is a big help. We will start by providing monthly data on the U.S. TIROS/NOAA polar orbit spacecraft. If there is sufficient interest *and* someone out there has access to suitably precise orbital data, we might later include some of the Soviet METEOR/COSMOS spacecraft as well.

Circuits and Projects

Another aspect of the column will be projects and circuit ideas. Big projects from my end will be handled in articles, but I will regularly include small circuit modules of interest, either of my own design or interesting ideas contributed by readers. Some of these will be fully engineered circuits, while others may be as tenuous as a new idea or approach that has not been fully evaluated. If we can keep everything suitably labeled, you will know whether you are dealing with a simple "cookbook" project or something to tinker with. I have innumerable examples of such little projects, none large enough to justify a complete article, but all of which are interesting and effective. I am sure that some of you have some of the same kinds of tidbits, and WEATHERSAT will provide the opportunity to share them with others (suitably credited, of course!).

Computers

The most obvious application for computers in the area of weather satellites is doing orbital calculations, but this is only the tip of the digital iceberg. Today even the most basic home computers can be used to automate the operation of your station: by recording satellite passes when you are off at work or vacation, by processing imagery in conjunction with an existing display system to enhance contrast or bring out specific details of interest, or by functioning to control a video scan converter to enable a conventional TV set or monitor to display satellite pictures!

Orbital predicts and station control can usually be accomplished in Basic, meaning that the project can be adapted to almost any computer. Image processing and scan conversion, however, require extreme speed, which can be achieved only with certain compiled languages or, more commonly, at the level of machine language or assembly language. These programs are very specific to the microprocessor used in a specific computer and are often machine-specific as well.

There is no way for me to try to instruct you in all of the possible kinds of assembly/machine language programming, but I will, on occasion, treat the *design* of program modules—basically approaches to handling image processing problems that should be applicable in a wide range of situations. Occasionally, I may present specific examples of programming code for the Radio Shack Color Computer or the IBM PC and clones—the latter because they are so universal, and the former because it is so inexpensive yet flexible.

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information on newly available programs or computer products with weather satellite applications, and I may occasionally be arrogant enough to include review comments. Here is another area where reader input is significant, for, while I am running Color Computers and PCs, I am not about to get one of every possible home or business computer. And if we are to cover products for other systems, your input, along with that of the equipment/software vendors, will be important.

The *Weather Satellite Handbook*

One very significant source of information for weather satellite enthusiasts over the years has been the first two editions of my *Weather Satellite Handbook*. The second edition has been out of print, causing quite a bit of consternation to those who would like a copy. To make a long story short, the *WSH* is back in the form of a third edition. The book has almost 40 more pages than the second edition (the *New Weather Satellite Handbook*), and virtually all the construction projects are in a new, modularized format. Many of the circuit modules are used in more than one project, and even if you choose to rebuild a module for a new project, you are familiar with it and have a working copy to compare with the new one! Computer coverage has been expanded considerably, including a universal PREDICT program in Basic and both theoretical and project treatment of digital scan conversion.

The entire structure of the third edition has been modularized to make it simple to update with the passage of time, and printing runs are kept small to facilitate this. I will continue to shamelessly promote the book for two reasons. First, it is being published by yours truly, and unless I sell some my wife will mutiny and that will be the end of the third and future editions. Second, in all modesty, it has been and is a supremely useful reference for both new and experienced satellite experimenters. It is available directly from me, at the address above, for $12.50 postpaid in the United States and Canada and for $14 elsewhere.

Pictures

In order to communicate some of the excitement of what we do, I intend to include satellite pictures in the column on a regular basis. For the first few columns, any of these will naturally be from my own files, but submissions from readers are encouraged. Such pictures provide a way of illustrating a wide variety of satellite products, not to mention the kind of quality that can be obtained using home-constructed equipment.

If you send in some pictures, please include only photographic or FAX prints, as slides are difficult to handle. In addition to basic information as to the spacecraft and image coverage, be sure to include information on the receiving and display system you used to produce the picture.

This month's specimen is a NE WEFAX quadrant, imaged by the GOES E geostationary spacecraft and relayed by GOES Central (see Photo A). The image covers most of the United States and Mexico and part of Central America. The picture was obtained in visible light, transmitted on 1691 MHz, and displayed on a standard TV monitor using the scan converter described in the third edition of the *WSH*. Display resolution is 256 pixels/line with 256 lines and 16 grayscale steps.

I have already noted the problems inherent in deadlines. The other major problem in running this column will be space. I have been allotted a limited amount of copy each month. *73* has been positive in its coverage of weather satellite topics in the past, and WEATHERSAT represents a new and tangible expression of that support.

Your support of this venture has three dimensions. First, contribute ideas, information, or questions when you think you have something of interest. The remaining two dimensions are interrelated. Every once in awhile, drop a note off to the friendly publishing/editorial staff to tell them what a wonderful idea it is to have a column like this in their magazine and, just as important, *buy* the magazine. The most cost-effective way to do that and not miss any coverage is to subscribe. Subscriptions make publishers very happy, and happy publishers are very flexible about continuing to invest in columns like this one.

Next Month

Next month we will look at the general subject of satellite receivers for the VHF range. ■

NEVER SAY DIE

from page 10

ago—I don't recall if I ever wrote about this.

It seemed that one of the graduates of a local Brooklyn street gang had come to him with a wild story. Several of his gang had joined the Air Force and had managed to get assigned to the same SAC group. They were waiting for the time when three were on the same flight together and then they planned to take over the plane and grab the nuclear bombs.

The idea was to set one up in Manhattan with a remote trigger and then demand a one-billion-dollar ransom—plus other demands. The government would have no choice but to pay and do anything else they asked, no matter how unreasonable.

The gang member who spilled the beans stopped the caper. The gang members were apprehended and the whole thing kept a total secret. What could the government do with those people? They sure couldn't just put them in prison and eventually free them.

My point is that, as crazy as that scheme sounds, it apparently came close to actually happening. One way or another, some group is going to get hold of a nuclear bomb. Fanatics will explode it where it'll do the most harm. Gangsters could demand more than we could give and detonate it—perhaps as a warning. If they had one they could have two.

When the nuke goes off we're going to have the same situation as California, only on the East Coast. Thousands to millions dead and perhaps tens of millions injured. That's going to take a lot of communications. You want to do anything about it or shall we just go on as we have and wait it out?

OLD FRIENDS

Are you taking advantage of the opportunities amateur radio offers you to find and develop friendships? Despite my wide range of interests, the friends I remember most fondly over the years have been ham friends.

Back in the late 40s I shared the low end of 75m with one Sam Harris W8UKS. Sam had a wonderfully wry sense of humor, so we got on famously. It was a bit frustrating for me when his 50 Watts of AM would knock my kilowatt out of the picture in South Africa. I had a pretty good dipole—Sam had a bi-square—so the ZS we'd talk to would tell Sam he thought he heard a slight heterodyne when I'd try to break in. Bah!

When I moved to Cleveland (changing to W8NSD at the time) to work for WXEL as a television director in 1951, I of course drove out to see Sam and his wife, Helen. I was surprised to find them living in the basement of their home. Well, Sam was building a house, so he first built the basement, then moved into it, and then quickly built his 120-foot tower. That's all the further he'd gotten with his home when I visited, ham priorities being what they were with him. His bi-square antenna hung from the tower. To turn it, Sam had to run out of the basement and trot the two sides of the antenna around with guy ropes. It had a whale of a signal—everywhere.

> ***"When someone you're talking with over the air sounds like fun and he says why not come over—indeed, why not? And maybe bring some cake."***

Sam, who died a few years ago, was a brilliant technician. In the 40s and 50s it was very unusual to run into someone with a beard—so naturally Sam wore one. I asked him if he noticed the stares it drew. Well, now and then he said he did—and wondered if maybe his fly was open.

Sam eventually moved to Medfield, an outskirt of Boston, to work for Microwave Associates. He had a basic mental problem—he had to have the loudest signal in the world on a band before he could be satisfied. This got him involved with some of the first moonbounce work on 2m—I think he had 14-elements on 20m. He changed his call to W1FZJ—then to W1BU.

When I took over *CQ* as editor in 1955, I got Sam to be my VHF editor. I'll never forget a great article he wrote on a contest 100-Watt final—complete with pictures of his finals. He had pairs of 1000-T finals, as I recall, for each band—running around 10 kilowatts or so each—all lined up around what had been his garage. I understood the FCC monitoring station in the next town had to shut down when Sam went on the air.

The article explained that the plate ammeter read a little high for 100 Watts—Sam suspected rf might be causing trouble. Sure enough, a quarter-inch bar of copper across the meter terminals shunted the rf and produced the expected 100-Watt reading.

This article was in response to the high percentage of operators who were winning the ARRL Sweepstakes contest by claiming to run only 100 Watts, thereby getting a 1.25 multiplier. Their rigs would be listed in *QST* with outlandishly high-powered finals—and 100 Watts input.

Sam was doing well until I moved to New Hampshire in 1962, soon after I started *73*. By 1963 I'd bought a mountaintop VHF location and set up 336 elements on 2m, 200 elements on 220, 400 elements on 432, and 16 elements on 6m. My 2m rig ran a kilowatt of rf with 4 kW of audio, producing a rather potent signal—all this from high up on Mt. Monadnock, the highest mountain in southern New Hampshire. Sam was stunned.

My 2m final was an old war surplus FM amplifier using 4-125As, modulated by the remains of a pre-war National 600 modulator, a beaut using Thordarson CHT transformers which I'd bought back in 1946—one of the better used-rig buys of my life. It easily punched 4 kW of audio into the final, providing a significant signal all down the East Coast; 600-mile contacts were common.

The next thing I knew Sam had moved to Puerto Rico and was gearing up the 1,000-foot dish at Arecibo for ham communications. Well, I couldn't top that!

Sam is the chap who invented the parametric amplifier, the device which added much to the range of military radars. He invented it on 6m and it was this device, I believe, which put Microwave Associates into big bucks. They're now MA/Com, the main outfit making satellite decoders.

Sadly, Sam was a heavy smoker—as was Helen W1HOY. This, I'm sure, shortened his life at least 20 years. We've learned recently that when a person dies, the spouse's immune system often weakens. Helen died not long after Sam, losing us a world-class 6m operator.

Now and then I'd get a chance to visit Sam—in Medfield—and then at Arecibo. We had a great time talking amateur radio, which he loved dearly—with Helen bringing him cups of coffee and perhaps some ice cream with blueberries. I don't think I remember a sit-down meal—just informal snacks now and then, brought to the operating desk.

Sam was a great ham, a wonderful technician, fun to talk with, and a solid friend. It's hams like Sam and Helen who have helped make amateur radio mean so much to me.

Another very good ham friend of mine has a wife who hates hams—including me, I suspect. All kinds.

Immediately after World War II I got back on the air—first on 112 MHz (two and a half meters), which was the first post-war ham band to open—then on 10m, which opened a few weeks later. I was stationed at New London, teaching radio and radar at the Submarine Base—having been transferred from my submarine in the Pacific just before the war ended. On weekends I'd drive home to Brooklyn, where I got on 10m.

Two of the more active hams at the time were Eddie Ricca W2OCL and Frank Rizzo W2OCM. Groups of local hams would often get together at Eddie's house in the evening to ragchew—and be served coffee and cake by his wife, Jeanette. Eddie was a projectionist at a local race track—he later moved to Florida and got involved with the International Traffic Net up in the 14.300s.

We built up quite a bunch of hams around Brooklyn on 10m in the evenings. The band was closed, so it was much like the old pre-war 160m band. We'd gather a group of maybe ten or so joshing each other and then someone would suggest meeting at Nathan's at Coney Island for a hot dog. We'd all drive out there and nosh. Nathan's, by the way, had the best hot dogs in the world.

Another old-timer I remember

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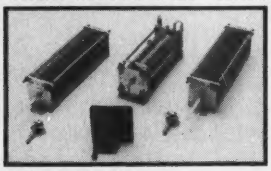

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fondly was Garald Silsby W1MCS, from my home town of Littleton NH. Sil ran a radio repair store in town and operated a 25-Watt 80m CW rig from his camp on Partridge Lake. He did radio repair the old-fashioned way—if a transformer burnt out he'd rewind it, not just reach for a replacement.

Then there was the first chap I contacted the day I got my ticket—Dexter Poindexter W2MCV. Dexter was the sort of ham who pored over the ham magazines endlessly, talking for hours on either 2.5m or 160m about his next big receiver purchase. Dexter lived for the day he would finally decide what receiver to buy. Alas, he spent more time than he had on the decision, dying before he bought the receiver he'd dreamed of for so long.

My rig was a 2.5m walkie-talkie built from an article in *Radio*—kind of the pre-war version of *73*. Two tubes and a pair of long lines for a tank circuit.

Hams still ask me about John Williams W2BFD—he died fairly young in 1961—smoking killed him. John was certainly the father of RTTY. He made the first deals to rescue Teletype machines from Ma Bell. He warehoused and distributed them. He designed the first circuits—which I suspect are much better than many we're using today. He (with help from me) set up the first two-meter repeater in the country to repeat RTTY throughout the greater New York City area. It was controlled on channel so the FCC was furious, wanting him to set up a separate 220-MHz control link. It worked beautifully.

John had other interests, too, as I found out one day when the FBI visited me. I later found out his electronic genius was also spent on making state-of-the-art surveillance equipment. He mentioned once providing the Arabs with bugs to put on Israeli diplomatic cars so they could hear what was being said inside.

John was careless, at times to the point of being crooked, with the delivery of Teletype equipment. But most of us used his designs and were held together by his signal from Woodside, Queens—and then by his repeater.

He built one of the first telephone answering machines. I've still got it down in my basement. He used a homemade phonograph record to answer the phone and a wire recorder to record the incoming messages. Bell really hated this, but John stood them off until he died. He lived about a mile from his radio repair store and connected the two via 162 kHz over the power lines so he was able to talk over his store telephone from home. Not bad for the 50s.

I met Walt Chamberlin W6LLP when he came to New York to install a color organ on a Guggenheim Fellowship. If you've seen the Guggenheim Museum on 5th Avenue, the color organ is the reason it's such a strange shape. The color organ was supposed to be the centerpiece, so Frank Lloyd Wright designed the building around it.

Walt was into RTTY, so he looked me up when he got to New York. He'd helped the color organ inventor, Charles Dockum, build his first test model and came with him to help build a bigger one.

Once the new color organ was up and running, Walt went back to Pasadena and I took over as the engineer on the project—mostly to keep it running. It was a great invention, but it took a lot of control equipment and power tubes to run the four 70mm film projectors, each with three films controlled independently. Alas, today you can do everything it could do—and more—with microprocessors, and you wouldn't even need the projectors.

I had more fun composing color/light programs on the organ than keeping it working and developing new circuits. Alas, eventually a new museum director was appointed and he nixed the color organ. It may still be sitting somewhere in a warehouse for all I know.

The organ was set up in the old Guggenheim building, on the same site as the present one. While I was working there I operated on 2m from the penthouse apartment overlooking Central Park. It was a great location.

I used to visit Walt in Pasadena in the 50s. He went to work for NCR making computers, and we drifted apart as I got to L.A. less often. I don't see him listed in the *Callbook*, so perhaps being a vegetarian didn't keep him alive. I can't imagine him dropping his ham ticket.

Oh, there've been many hams I've known down through the years—some wonderful people. But you have to take time to develop friends. When someone you're talking with over the air sounds like fun and he says why not come over—indeed, why not? And maybe bring some cake.

Here you have the whole world at your fingertips—thousands of fascinating people anxious to talk with you. You sit down, turn on the rig switch and there they are. If you want to be alone, off goes the switch and you're by yourself. If you want good friends you're going to have to work at it—and you'll get out everything you put into the relationships, and then some.

Of course if you're a snide, sarcastic, put-down person, the more you put into a relationship, the less you'll get out. You might want to tape a few contacts and then sit down and listen carefully to them to see what kind of a person you are to contact. Are you someone you'd call again? Some people are so used to being negative they spread gloom with every contact. It can take hours to air out a frequency after a couple of chaps like this have been bitching.

You might want to explain that hamming is supposed to be fun the next time you hear a curmudgeon griping—but be prepared for the blast of fury. No, I don't think you'll find anyone with the guts to back you up—you're on your own in trying to improve our bands. The most infuriating thing you can do is be unflappable.

Both you and I will enjoy hamming much more if we do our best to avoid the rotten operators and look for the chaps who are fun to talk with—who are worth developing as friends. ■

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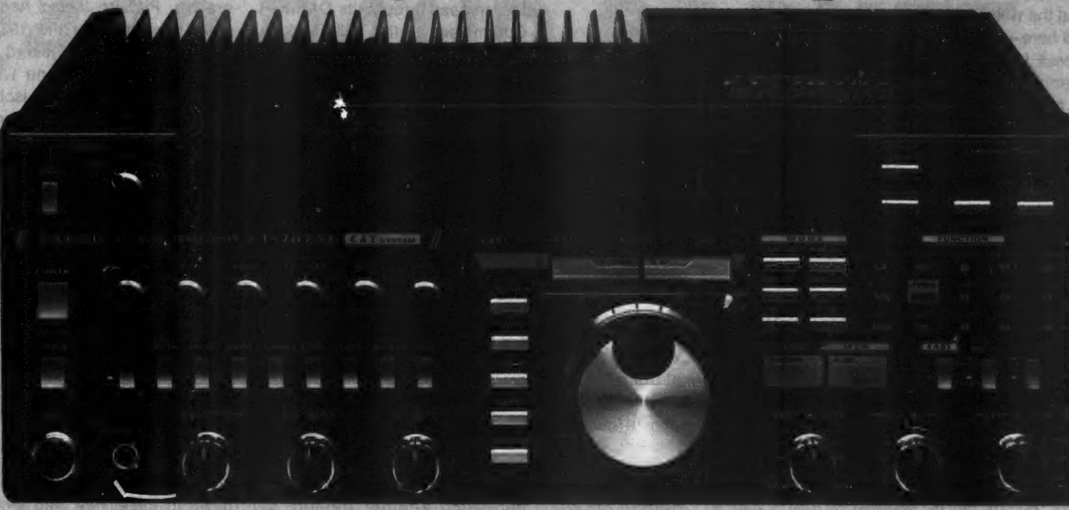

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73 INTERNATIONAL

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NOTES FROM FN42

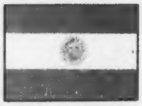
There are many activities around the world that could be reported here—which *you* could tell us about firsthand if they were happening in your country... much better than we could, using secondhand information. The July issue of *World Press Review*, published in New York, excerpted from press reports on new satellites in Japan...on the personal computer boom in the Ivory Coast and Senegal Republics...and on an aspect of the government in Norway, which perhaps could mean more Norwegian YLs and XYLs.... Is there anyone out there who can tell us more than the following?

NKH (Nippon Hoso Kyokai), Japan's giant public broadcasting system, is experimenting this month with the new television satellite, the BS-2b; its made-at-home BS-3 is scheduled to fly in 1988. NKH *encourages* private dish antennas; half a million are expected by 1988. (From remarks in Tokyo to *WPR*'s "World Beat," by Norio Shimamura, NKH editor for foreign news.)

Personal computer nets are popular in two African countries, Ivory Coast and Senegal; Senegal reportedly unveiled the first PC to be designed and built in Africa. It is a computer boom, according to El Inkichari, in the Paris *Le Journal de L'Economie Africaine* [5/15/86].

Is the Norwegian Telecommunication Direktorat headed by an XYL or YL? That's a reasonable question since Norway now leads the world in the number of women in top governmental leadership positions: Gro Harlem Brundtlandt is Prime Minister, and she has named women to seven cabinet posts—which is nearly half of that body. (From an article by Birgit Wiig in Oslo's *Dagbladet* [5/20/86].) If so, could that not lead to an increase in the number of YL and XYL ops in that country?

Let's hear from *you* (particularly if you know more about the above) and from more countries. This is an *"International"* column! We've "flown the flags" of 59 countries so far, with no nationalistic sort of favoritism (amateur radio is an *international* hobby) —let us "fly" your flag, too.—*International Editor.*



ARGENTINA

Marcelo "Mac" F. Avila LU5EIC
Radio Club Boulogne
C. C. 39-(1609)
Boulogne Sur Mer
Buenos Aires
Argentina

I've much pleasure writing you about the new special callsign that began appearing this year and will be used through this month [October]. The Secretaria de Estado de Comunicaciones (Communications State Secretary) has authorized Argentine amateur radio clubs to use the AZ1ARU callsign to commemorate the IX Plenary Assembly of IARU Region II in Buenos Aires this month.

The Radio Club Argentino (LU4AA) uses the call without the portable; all other ARCs use one, as mine (Radio Club Boulogne) uses AZ1ARU/15, that can be considered as an AZ15 prefix.

All stations have a QSL Manager, using his own or the club callsign (Radio Club Argentino uses its own; Radio Club Boulogne uses mine: LU5EIC). Be sure to use the QSL information you are given by any AZ1ARU station you contact!

AUSTRALIA

J. E. Joyce VK3YJ
44 Wren Street
Altona 3018
Victoria
Australia

DOC GETS TEETH!

Thanks to the long-awaited replacement of the 80-year-old Wireless Telegraphy Act with the Radiocommunications Act, the Department of Communications now has a "vitally important" tool for the efficient management of the radio-frequency spectrum. There is a vast range of uses being made of the spectrum, and the new Act recognizes the modern electronic environment and the issue of electromagnetic compatibility (EMC).

Formulation of the Act over the last 15 years involved the slow process of consultation with manufacturers, importers, and all spectrum users, and the Wireless Institute of Australia was a part of the process through its CASPER Committee; all this will continue as regulations and standards evolve.

DOC will have new powers to deal with all forms of radio frequency interference, from *all* sources—power lines, electric motors, welders, thermostats, and so on. TV sets, VCRs, stereo units, intercoms, and other such devices sold in Australia will have to meet standards of immunity to RFI. It will be an offense to supply, possess, or use equipment manufactured after the setting of standards which does not comply with those standards.

The Act redefines a number of new offenses, such as using a transmitter that causes interference to safety communications, harassing another person, or sending hoax calls. In the last category, differences are clear from two hoax cases, the first prosecuted under the old Act and the second under the new. A Queenslander who made repeated calls to emergency services on marine distress channels, claiming he was in a boat with others outside the Southport sandbar when he was, in fact, transmitting from his home on equipment borrowed from an equally unlicensed friend, lost the equipment and was fined $300 plus costs. Just recently, another Queenslander made straightforward distress calls to the Cairns Coastguard—and he was fined $2,500 and lost a $150 marine transceiver and a $200 CB transceiver.

I must thank the WIA's amateur radio magazine and Mr. Bill Palmer, DOC Public Relations, for the above information.

NORFOLK ISLAND

Kirsti Jenkins-Smith VK9NL
PO Box 90
Norfolk Island, 2899
Australia

When the Pitcairners stepped ashore on Norfolk Island in 1856, they looked around them in amazement. These were the second and third generation descendants of the famous Bounty mutineers who had sought refuge on Pitcairn Island after casting Captain Bligh adrift in an open boat.

As generation followed generation, Pitcairn Island had become too small for the 193 descendants. A larger island was needed, preferably one where they could continue their isolated existence free from interference from the outside world. So Norfolk Island had been offered for their new home. The penal colony had been closed, leaving buildings, fields, and livestock for the Pitcairners' use.

The people, after an exhausting voyage of over 3,000 miles, lasting five weeks, felt bewildered. Stone buildings, some two or three stories high, looked large and formidable. And the herds of cattle grazing were something new. They had had nothing like that on Pitcairn.

Many found it difficult to settle down in these new and strange surroundings. Their very life style was changed. And before long, several of the Pitcairners contemplated a speedy return to Pitcairn. Two and a half years after their arrival, two families returned to Pitcairn Island. An extract from an old diary on Norfolk Island reads: "...after a scene of sorrow and pity, several of the relatives going into hysterics, etc., they embarked and in the afternoon sailed...."

In 1864 a second group departed Norfolk for Pitcairn Island. And so we have it that the descendants of the Bounty mutineers are to be found on both Norfolk and Pitcairn Islands.

Relatives were separated for years with no news, although a few letters found their way by slow—very slow—mail. But maybe the longing for a return to Pitcairn was laid down in the Norfolk Islanders' genes. As the years passed, each generation talked about Pitcairn Island and how they wished they could see it one day.

With the coming of amateur radio, communications were improved. John VK9JA and Ray VK9RH (now SK) talked regularly with Tom VR6TC, who was the only operator on Pitcairn in those days. By 1984 the amateur radio population on Pitcairn had doubled—to two resident operators. Kari VR6KY had been active for some time, and she and I provid-

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ed another link between the two islands.

It was now that the day finally came to pass that generations of Norfolkers had longed for. A group of people from Norfolk Island travelled via New Zealand and Tahiti, then onward by chartered vessel, to Pitcairn Island...and the way these long-lost relatives greeted each other gave no indication of the passage of 120 years since the last group had departed Norfolk Island for Pitcairn.

Anticipation had been strong. On Norfolk Island we received via amateur radio hasty little progress reports from Pitcairn while the group was en route. "We are busy baking extra bread...we are giving our houses a good spring clean...do you know the names of those coming here?" And then finally, "The men are all up in the hills on the lookout for the ship!"

Oh, joy! Eight days of talking, laughing, exploring the island, singing, and feasting. Then time for departure.

The bonds between the two islands had been strengthened. Fortunately, propagation was not too bad in the months that followed, and one day Kari and I set up a special Christmas sked. She would gather a group of Pitcairners in her house and I would gather a group of Norfolkers in my house. A little mike-shy to begin with, "my" group soon warmed up. So did "Kari's" group. Soon everyone was bubbling over with things to say, questions that wanted answers, and promises of visits to come.

Pitcairn and Norfolk have their own version of the English language. Called Pitcairnese and Norfolkese, it is a mixture of 18th century English and Tahitian words adopted from the mutineers' Tahitian wives. The language has survived successfully even here on Norfolk Island, which has been subjected to a large influx of new settlers. So the one-hour Pitcairn/Norfolk sked was conducted in their own language. Later, to tidy things up, Kari and I tied the ribbons on the sked in Norwegian!

The exercise proved that amateur radio is an excellent medium for keeping isolated communities in touch on a more personal basis than telephone calls or infrequent letters. At present propagation is too unreliable, but once that improves Kari and I will resume our regular skeds, helping to strengthen the tie between these two islands which share an interesting chapter in the history of the South Pacific.

BRAZIL

Carlos Vianna Carneiro PY1CC
Afonso Pena, 49/701
20270 Rio de Janeiro
Brazil

CW GOLDEN HOURS

It happened in Rolandia, Parana State, when Flores PY5BXW suffered a heart attack which damaged almost three-fourths of his heart and left him unable to move except for slight finger wiggles and winking eyelids.

Taken to the hospital, almost no hope given him by the medical team, unable to communicate in any way, Flores seemed condemned—when his wife, Cida, remembered CW and asked her son if he thought Flores would be able to understand a CW message. Her son called on a friend of Flores, Rossini PY5CFT. At the hospital emergency center, earphones were placed to Flores' ears and, by Morse code, Rossini asked Flores to wink his eyes if he understood the message.

There was winking, and Rossini told Flores that he was going to put an oscillator key under his fingers, hoping he would be able to express his feelings.

Then, like a miracle, Flores started slowly but steadily to send a message about some strong pains, thus allowing immediate help from the medical team and bringing Flores such relief that the whole situation was changed: Calmness and courage resulted in new hope. The medical team was astonished with what they were seeing, never having imagined that a motionless patient could ever communicate information about himself.

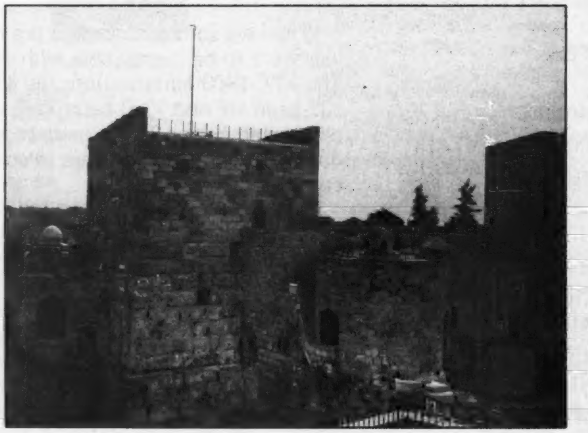
Rossini stood by from then on, always ready to copy Flores' messages and translate them to the medical team and family. Anguish and the barrier of silence were surpassed, and little by little Flores' CW messages poured from his fingers, instructions to his sons about how to take care of the farm and lands—and of everything else, showing that Flores knew how severe the heart attack had been.

"Cida, if anything happens, I want you to know you were the happiest thing in my life..." was one of his messages.

Morse code. What so many have called "good for nothing" cannot be judged if measured or imagined by common parameters. Is it worthwhile knowing? Well, "knowing takes no space and has no weight...."

Unfortunately, Flores could not stand such a severe infarct and died three days later. "Rossini, I feel I'm going to die," was Flores' last message, this one very hard for Rossini to get despite his CW skill.

Although he dedicated his whole amateur radio life to CW operation, we don't think Flores ever imagined he was going to write such Golden Hours to CW, a so important example for us all to think about.



The site of 4X5J, David's Tower on the walls of the Old City of Jerusalem. The station was housed in the room under the tower for the tribander. (Photo by Eli Hadashi)

ISRAEL

Ron Gang 4Z4MK
Kibbutz Urim
Negev M. P. O. 85530
Israel

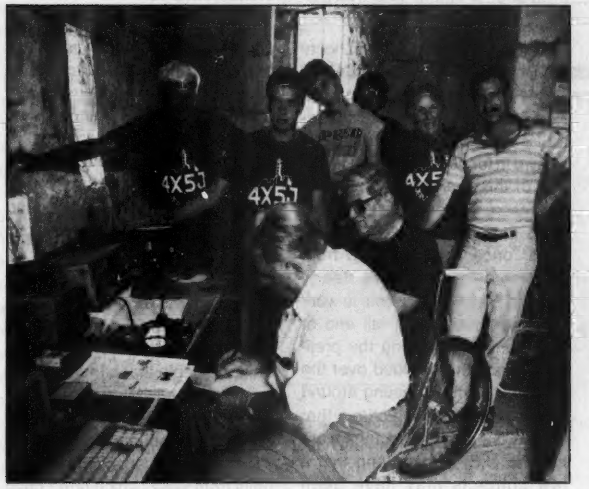
ACTIVITY WEEK—OLD CITY OF JERUSALEM

Readers of my April and September columns last year, here in *73* International, will recall the 4X5DS expedition to the lowest spot on the face of the Earth, the Dead Sea. The Holon Bat-Yam Club, which pulled off that operation, decided that this year they would do a similar week-long stint, but this time, as Aharon 4X4AT put it, to the highest spot in the world—spiritually speaking. Hence, the 4X5J operation.

After careful preparation of equipment and skyhooks and securing the necessary authorizations from the authorities-that-be, the station was set up in David's Citadel just inside the Jaffa Gate of the Old City of Jerusalem's walls. The time: from the 24th of April through May 1, the week of the Passover festival, when schools and many businesses are closed, ensuring sufficient numbers of operators for around-the-clock activity.

It would seem that the operation enjoyed the full support of nature, as the tribander and dipoles perched on the Pata'el Tower, two transceivers and their amplifiers performed flawlessly throughout the week-long period. Not only that, but conditions were excellent, especially for this juncture of the sunspot cycle. The evidence: over 8,000 contacts with 120 countries and 47 American states.

Publicity wasn't lacking, either. Israeli television was on hand, and the viewing public was treated to a four-minute-long item on the late-night news showing antennas, the station in operation, and an interview with the chairman of the Israel Amateur Radio Club (IARC) explaining the importance of the operation. Israel Radio's English language service also devoted time to the activity, and on Ben Dalfen's DX Corner (4Z4JS) on the Overseas Service, listeners received full information on 4X5J.



Mayor Kollek signs a QSL card as Aharon 4X4AT watches. Standing, from left: Amos 4X6PH, Amir 4X6TT, an unidentified SWL, Asaf 4X6MH, Shoshana 4X6OL, and Dudu, the manager of the David's Citadel Museum.

Mayor Teddy Kollek of Jerusalem paid a special visit to the station and made a contact in the German language with DJ8OT. The public, including many tourists, also visited, and, indeed, the activity was such a hit that the curator of the King David's Citadel Museum, in the rooms of which the operation was housed, invited the operators to return each year, making it an annual affair.

A revival in activity on HF took place with the Jerusalem amateurs, who discovered that with 4X4J operation hams worldwide were interested in the coveted Jerusalem Award. As a result, they pressed their stations into activity and found themselves to be very much in demand.

Jerusalem Award Changes

The requirements for the Jerusalem Award have been considerably relaxed, making it much more readily available for most amateurs. All that is required now are contacts with four *different* Jerusalem stations, and no more. QSLs are not necessary—just a log of the contacts verified by two other licensed amateurs, sent along with four IRCs to the award manager, Dr. Milt Gordon 4X6AA, PO Box 4079, Jerusalem, Israel. However, if you were fortunate enough to make contact with 4X5J, then the Holon Bat-Yam Club will take care of all expenses for the award and no IRCs will be necessary. Send your log, with the record of the contact, to 4X5J, c/o The Israel Amateur Radio Club, PO Box 4099, 61040 Tel Aviv, Israel. To the best of my knowledge, the club is already sending out QSLs for all contacts with 4X5J, making absolutely no solicitations, in the same way that they handled 4X5DS last year.

In summation, the 4X5J operation was a big success. Thanks are due to scores of hams who gave freely of their time, equipment, and funds to make this DXpedition the triumph that it was. The Holon Bat-Yam has some different plans for next year. What they are is not yet known, but I shall try to inform you in advance!

BIG EXAM TURNOUT

While amateur radio seems to be declining in many countries, it seems that the great publicity received by ham radio in Israel coupled with hard work by the Elmers or counselors at the various local clubs has really paid off.

In the spring examinations for the amateur radio license, 170 examinees came for the three different license classes! The results are not out yet, but according to IARC volunteer observers, the percentage of those passing was high.

Although according to a survey made on the air that most amateurs here would favor some kind of code-free license giving some kind of VHF privileges, the Ministry of Communications still does not favor the idea. Even so, amateur radio here is still growing; but it would seem that we're losing many talented youngsters to computers as a result of the licensing requirements.

The 4X5J QSL card shows The Citadel.

VISITOR LICENSING

It's time to remind you that when you visit here you should bring along a small, two-metre hand-held and meet the hams here, thus adding a beautiful human dimension to your trip to Israel. On a radio program recently I heard the figures regarding the number of murders per capita in large cities in America and Europe. It was interesting to note that in spite of the big terrorist scare keeping people from going outside the borders of the U.S., the number of those meeting violence in Israel is *considerably* smaller than that of major American cities. You are immensely safer on the streets of Jerusalem or Tel Aviv than in New York, Chicago, L.A., Detroit, etc., and you can stroll safely at all hours.

If your country has a reciprocal licensing agreement with Israel or if you can provide proof that Israeli hams receive licensing privileges in your country without additional exams, then when you come bring your valid amateur license with you (NOT a photocopy). Your reciprocal license shall be granted on the spot, free of charge. Just appear at the Ministry of Communications' offices on the tenth floor of the Shalom Tower on Ahad Ha'am Street (it is Tel Aviv's tallest building). Office hours are 9 a.m. to 1 p.m., Sundays through Thursdays; the phone number is 610-278 (dial 03 first from outside Tel Aviv).

I'll write soon to bring you up-to-date on all the repeater channels. Hope to work you on two metres—remember, Israel loves visitors!

PHILIPPINES

(We are half chagrined, half confused, and half pleasantly mystified about the material we published in the March, 1986, issue from Senor Leo Almazon WA6LOS/DU2, our Philippines correspondent. It included interesting information about a February, 1985, Hamvention—not exactly hot news, but in this column that doesn't matter—and went on to mention "the plan for the next SEANET convention. . . in DU-land [and] the tentative dates are November 22 through 24. . . ."

(It was too late to do anything about that when we suddenly realized that that SEANET affair had already been held, five months before, in November of 1985.

(Now we have more material from Sr. Almazon, just as interesting as his material usually is, postmarked June 24, 1986. We decided to read it carefully! It speaks of a decision which "will be heard after the Presidential election in February." And it ends with his plan "to attend my very first Dayton Ham convention. I will drop by the 73 Magazine booth and say my hello. . . ."

(Some of you who see American TV will know what we mean when we say we felt as if we were suddenly in The Twilight Zone! Yes, the Dayton Hamvention was held two months before Sr. Almazon's communication to us was postmarked. Of course there is a simple explanation! We will share it with you when we find out what it is. Stay tuned.) ■

ABOVE AND BEYOND

Number 13 on your Feedback card

Peter H. Putman KT2B
84 Burnham Road
Morris Plains NJ 07950

A few months ago, I touched on the importance of 6 meters during the early (June and July) VHF contests. Many a great effort has been made by the grace of a strong Es opening on 50 MHz!

It's been a few months since the running of the 1986 *CQ* WW VHF WPX Contest, but 6 meters came through in a big way to help our group (SCORE, operating KC2PX) ring up some interesting totals.

Overall, 6-meter activity was fairly good locally. But when the band opened up, things got interesting! Just prior to the contest, there were strong Es openings to virtually every part of the country—from Newfoundland to California. These openings lasted off and on for several days and activity was detected from Minnesota to Missouri the afternoon of July 18 as I set off for our contest site.

Alas, Murphy stepped in and the scatter disappeared, but only temporarily! For the first 2-1/2 hours, we worked into New England, eastern Pennsylvania, New Jersey, Maryland, Massachusetts, and New York with signals consistently about S9 to S3. Suddenly, at 10:30 p.m., in the midst of all these local contacts, two stations from grid square DN13, western Idaho, punched through with S9 signals, and exchanges were quickly made! Our excitement rose and we were rewarded with intermittent Es openings for the next 1-1/2 hours into Florida, Arkansas, Tennessee, Alabama, and Texas.

I found myself in a rag-chew at midnight with K5UR in Arkansas and N4EJW in Florida (both stations were S9 +20), lamenting the lack of activity for such a great opening! The late hour may have had something to do with it, but 6 continued to show sporadic openings throughout the night, and many stations that we might have struggled to work on meteor scatter were "easy pickin's" via Es.

We resumed operating the next day at about 7:30 a.m., running local stations for a bit. A few meteor scatter contacts were made into the Midwest, but things were quiet until about 2 p.m. when the band opened up again, this time into Florida, Tennessee, and even as close as North Carolina! Stations were worked at the southern tip of Louisiana (EL59) and along the Florida panhandle (EL79). The skip appeared to be concentrated mostly in the Deep South, with occasional pings from Missouri and Texas.

Periodically checking the logs made for an interesting contrast since the 2-meter station was running about double the contacts, but 6 was producing twice as many prefix multipliers. More stations were bagged along the Gulf Coast, indicating the presence of an E-cloud somewhere over the Tennessee River valley. We suspected, and rightly so, that we would soon be hearing from states north of the E-cloud. Sure enough, here came contacts in EN51 (west and south of Chicago), EN41 (western Illinois), EN10 (southeastern Nebraska), and EN31 (Des Moines).

The 6-meter operators were busier than one-armed paperhangers at this point. It was a good opening—no terrifically strong signals, but plenty to work with—when another surprising development took place! In the midst of running the Midwest contacts, some Southwestern grids started popping through, such as DM84 (eastern New Mexico/western Texas), DM41 (Mexico/Arizona border), DN07 (Yakima, Washington), and CN85 (Portland, Oregon). This was getting interesting.

At this point, about 9 p.m. local time, we were working stations from Florida to Washington, with New Mexico, Arizona, Idaho, Texas, and northern Minnesota thrown in for good measure. It was one of the stranger Es openings I've seen, for despite the westward and northward trend, we never once heard a peep from California—a prefix we dearly needed. Yet, we were able to work Newfoundland at the tail end of the opening, indicating the presence of another E-cloud over the Atlantic! (Rumors floating around Sunday morning indicated that indeed G2 and G3 stations were hearing U.S. signals, and that a few contacts may have been made.)

This was the last substantial opening for the rest of the contest. During these two openings, KC2PX logged about 100 grid squares as well, making VUCC in two days. The enclosed map (Fig. 1) gives you an idea of what was worked from our location in Belle Mead, central New Jersey (grid square FN20). It's apparent that the E-clouds occurred mostly over the Mississippi valley and the Tennessee River valley, accounting for the activity in the eastern half of the country. What caused the openings to the west? Most likely double-hop sporadic-E, not a very common occurrence!

We finished with 234 QSOs and 81 prefixes on 50 MHz, meaning about every third station worked was a new prefix. Contrast that with a total of 379 QSOs on 144 MHz and 68 prefixes, which works out to about a new multiplier every sixth contact. No doubt about it, 6 meters is a very important band during a VHF contest.

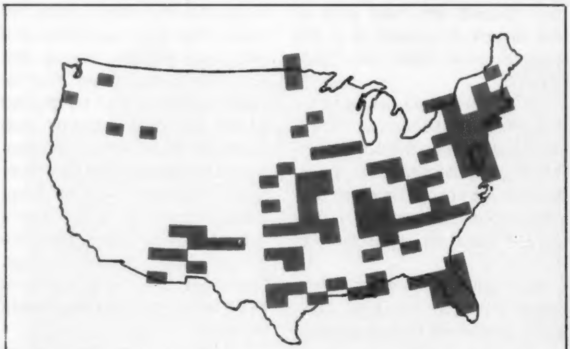


Fig. 1. Grid squares worked by station KC2PX during the 1986 CQ *WW VHF WPX Contest.*

Measurements

Every VHFer likes to know more about what's going on in his or her station with regard to performance . . . such as antenna gain, noise figure, power output, swr, etc. Some of these quantities are not easy to measure, but some are and I'll try to suggest some appropriate test gear that can be found cheaply at flea markets to do the job.

Let's start with the most popular measurement: power. I personally rely on Bird model 43 wattmeters and elements, but there are other units available that can do the job nearly as well. Mirage makes a nice line of VHF/UHF wattmeters that are reasonably priced in the $100 range. Also available are units from Welz (which don't have the resolution of a Bird but are reasonably close on VHF) and from Daiwa (which are less accurate than the Welz, based on my own observations).

Heathkit used to make a nice wattmeter for VHF called the HM-2102, which was surprisingly accurate. It used a toroidal coupler (as does the Daiwa) for both 50- and 144-MHz measurements. These can be found for about $25 to $35 at flea markets. The newer Heath meters work much the same way, but I haven't had a chance to use one and evaluate it. EME Electronics in Germany makes a nice multiband unit using a 50-directional coupler and voltage dividers to achieve coverage on 144, 432, 1296, and 2304 MHz.

Of course, you can roll your own, too. Circuits have appeared in the ARRL *Handbook* for Monimatches and 50-Ohm transmission-line couplers that can be made from PC board and plumbing supplies. A Monimatch circuit can also be used to indicate swr by calibrating the Reverse Power diode's output. Fig. 2 shows a typical Monimatch circuit with the bare essentials. This is similar to the cheap wattmeter I wrote up for *73* in September of 1984.

Another excellent meter that has been around for a long time was made by the MC Jones company of Bristol, Connecticut. You'll often find them attached to a resistive-type coupler in a cylinder with SO-239 connectors at either end. MC Jones also made a line of UHF and VHF directional couplers with microwave diodes that work very well. I have seen these available at numerous hamfests for about $25 for the meter and resistive coupler, and the VHF/UHF couplers usually run in the range of $20–$30 apiece.

Last month I outlined a procedure for gain measurement using a known signal source. Where do you get the source and how do you measure it? There are plenty of surplus test equipment buys at flea markets. You might be able to find a Boonton Radio rf signal generator for a reasonable price. I saw four at Dayton this year for about $50–$75 each. They will cover up to 200 MHz in band-switched ranges. If you have a bit more cash, $200–$300 will get you a Hewlett-Packard 608 series rf signal generator, with outputs up to 450 MHz depending on the letter code following the model number.

Boonton Electronics makes many fine millivolt and milliwatt rf meters that can be had reasonably if you look hard enough. I picked up a model 902 for a song, but had to fork over $50 for a surplus 50-Ohm detector head (good to 600 MHz). This is what I use to align transverters and other low-level signal sources. I also employ a good frequency counter made by Ramsey Electronics. You don't have to spend a fortune to get a good counter, only about $65–$95 for coverage to 600 MHz if you look around.

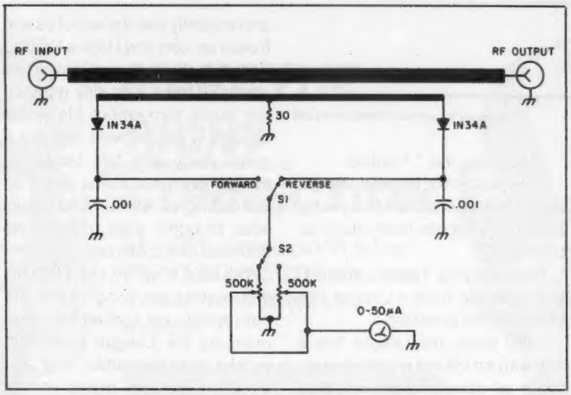


Fig. 2. The simple Monimatch circuit is the directional coupler found in most rf wattmeters.

And, of course, let's not forget the time-honored VTVM (or its modern-day counterpart, the FETVOM). This may be the most useful gadget around the shack for making voltage, current, and low-level rf measurements. You can fabricate a 50-Ohm coupler and use the VTVM/FETVOM as a meter readout for power and swr if need be. Such a VTVM might run from $25 to $50 in a flea market. As I come across other surplus buys, I'll keep you posted via this column.

Where Is Everybody?

I hear stories often of the newcomer to VHF or UHF who spends $900 for a multimode radio, antenna, and amplifier, only to complain that there's no one to work. If you tune around 432 MHz on a Saturday afternoon, that would be a valid conclusion! It's time to talk about the concept of activity hours, when your chances of making a QSO improve by leaps and bounds.

On the East Coast and in much of the country, certain hours of certain evenings are designated activity hours to encourage operators to get on the more popular VHF and UHF bands. The convention is that Monday is 50-MHz and 144-MHz night, Tuesday 220-MHz night, Wednesday 432-MHz night, and Thursday 1296-MHz night. In addition, the following hours are used conventionally for activity any night as well: 8–9 p.m. local, 220 MHz; 9–10 p.m. local, 432 MHz; 10–11 p.m. local, 1296 MHz. Also, during contests you'll find the most activity on these bands during these hours. It saves you having to waste your valuable Sunday afternoons calling CQ on 220 MHz until you're blue in the face.

That's it for this month. I'd like to hear from any readers who participated in last summer's contest schedule and their comments as well, with particular interest in portable or mountaintop operations. Until next month, see you Above and Beyond!■

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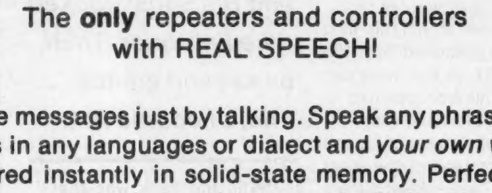

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ME AND PRESIDENT FAHRQUAR

Have you ever heard of former ARRL president Roland P. Fahrquar? Neither have I. But since I'm about to tell you a slightly embarrassing story about an ARRL president we have all known, and since I don't want to lose my house to a messy libel suit, let's just give him that name. Roland P. Fahrquar. President Roland P. Fahrquar. Sounds like a League president's moniker, doesn't it?

Anyway, our story begins at a League convention some years back. My brother Jim WB2LWJ and I had just been licensed for a few years and we decided it was time to see what these ARRL shindigs were all about. So we were in this Playboy Resort hotel in rural New Jersey, and on the first day we were in an elevator traveling to the fourth floor to see the world premiere of a brand new ham radio film, produced by the League.

So we got into this elevator. Almost immediately, I recognized the face of President Fahrquar. I mean, how could you not recognize him? Each month, his mug was literally plastered over the pages of *QST*. In the November issue alone, his face appeared no less than three times. On page 11, Fahrquar was presenting the Buckeye Amateur of the Year Award to a 7-year-old who managed to save an entire family by diverting a lightning strike through his Lafayette code practice key. Page 32 pictured Fahrquar representing the International Amateur Radio Union at the World Administrative Radio Conference (held on the French Riviera, of course). And, just for good measure, Fahrquar was shown on page 62 cutting the ribbon at the opening of the new Andy Devine Annex to League headquarters. This was a man very conscious of his public image.

So anyway, here we are all in this one elevator, Fahrquar, my brother, and me. Jim obviously failed to realize we were in an exalted presence.

"I hope this film is good," said brother Jim.

"I hope so, too," I replied.

"I hope it's not like the one we saw at the Novice class last year," he said. "That one really stunk up the room."

I began dying. I mean, after all, one does not insult a League film in front of the president.

"You know, the League has a real warped idea of what film making is all about," said Jim, now seriously into his film critic mode. "They think they can stick Arthur Godfrey and a ukulele into a picture, show the guy's million-dollar ham shack, and win over the kids. They're full of it."

By this time, I was inspecting the cobwebs on the elevator's ceiling, and Fahrquar was blowing smoke rings out of his ears. Turning toward Jim, Fahrquar, barely able to speak, croaked out, "Well, maybe you'll like this film better." The doors opened and he stalked out.

> ***"For an instant that distressed-looking fellow in the sculpture "Ugolino and His Sons" looked like Fahrquar. Then, on second glance . . . no, of course not."***

"Who the heck was that?" asked Jim.

"Roland P. Fahrquar, the ARRL president," I said.

"Golly, I hope he didn't take it personally," said Jim.

Over the course of the next several months, Jim and I ran into Fahrquar on a number of occasions. Pretty soon, we took to, as Jim termed it, "Freaking out Fahrquar."

It would work like this. Say Fahrquar was the scheduled speaker at the Hall of Science Radio Club, a popular ham radio establishment in the late 1970s. Jim and I would grab front row seats. We would dress identically in traditional ham garb: slacks, red plaid flannel shirts, and baseball caps. Fahrquar would arrive at the podium, look up to deliver his speech, and instantly see the two of us and freeze up. Jim and I look a lot alike (fat and dopey), and since we would sit there with silly grins on our faces throughout his entire speech, it would throw him into a panic, really rattle him. Maybe he thought we were aliens intent on subverting the ARRL. Who knows what thoughts pass through the brains of ARRL officials.

We kept it up. At the LIMARC flea market on Long Island the next spring, we spotted Fahrquar manning the League table. We walked up to the exhibit in unison and, in a nursery rhyme sort of sing-song, jointly chanted the words:

"We Are Here to Offer Our Services to the ARRL;

If You Don't Want Us, Just Say, 'Go to . . .' "

Well, you can guess the rest of the rhyme.

Fahrquar got a sort of ill look on his face and shooed us away.

After awhile, we got bored with the whole thing. I mean, how long can you pick on an ARRL president? It got to be kind of cruel—like teasing goldfish or stealing your pet dog's favorite bone. It just wasn't the sort of thing we wanted to keep on doing.

But then something strange happened. Try as we might, we couldn't get away from old Fahrquar. For instance, Jim and I would drive out to Harrison's, the big electronics store out on Route 110, and there would be Fahrquar idly spinning the vfo on a Drake TR-4C. He would give us a sly sort of smile and then disappear behind a rack of RCA connectors.

This happened a few times. We would go to the local repeater council meeting, and there would be ol' Fahrquar grinning at us. We would help out at the March of Dimes Walkathon in Manhattan, and there was Fahrquar, eyeing us over the top of an HT-220. What was going on here? We were supposed to be freaking him out and here he is grinning at us and making us . . . the great freaker-outers . . . feel very, very uncomfortable.

Soon, Fahrquar was popping up where he had no business being. I mean, running into the old fella at an electronics store or a repeater council meeting made sense, but how could you explain seeing the guy at a movie theater in Forest Hills or playing the slots in Atlantic City? League presidents don't play slots. I mean, what sort of an example would that set for Novices? Most Novices I'm familiar with settle for nothing less than baccarat.

There was no explanation, of course. Or was there? Sure . . . it was a League plot. Yeah, right. The League was out to get Jim and me. No, that's crazy. Why should the League be out to get us? No, Fahrquar was after us. He was giving us his righteous retribution for laughing at the film and playing gags on him at the Hall of Science. Or was he?

We were kind of confused.

Over the next few years, Fahrquar kept popping up in the most unusual places. But, unlike in the past, he became more unobtrusive. There was no grinning, no sly looks. We would be at the ballgame at Shea Stadium and for one crystallized moment there would be Fahrquar buying a hot dog at the concession stand. Or, we would be walking down Fifth Avenue and Fahrquar would suddenly appear in the crowd, walking in the opposite direction, and then just as suddenly vanish. Once, Jim and I were at the Metropolitan Museum of Art and for an instant that distressed-looking fellow in the sculpture "Ugolino and His Sons" looked like Fahrquar. Then, on second glance . . . no, of course not.

Fahrquar retired a few years back and Jim and I haven't been as active in ham radio as we used to be. Jim went on to college and sort of lost his interest in the hobby. I continue to write for this magazine, but I'm not on the air nearly as much as I used to be. My job writing about the computer industry and other demands of life have kept me from operating as much as I would like. At best, I manage a couple of hours a month lately. These combined factors seem to have finally removed Fahrquar from our lives. The last apparition appeared at a New Year's party, when Jim and I thought we saw the former prez's face within the bubbles inside a glass of champagne. That may have been the result of too much good cheer, however.

The other night I slipped into my shack and fired up the old Kenwood. Slowly, I brought the tribander around on a direct north heading. The speaker crackled with QRN, and I could barely make out a QSO deep in the background. And for a moment, just a moment, I thought I heard ol' Fahrquar's call. I contemplated giving Jim a ring on the landline to tell him about it, but thought better of it.■

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DX

Number 16 on your Feedback card

B. Gun
c/o 73 Magazine

Imagine our surprise when we opened the premier installment of our new DX column and read "Please don't give me a byline this month!" Seems our man is a bit harried and felt that there wasn't enough time to put together a "respectable" column. Heck, we gave him a week.

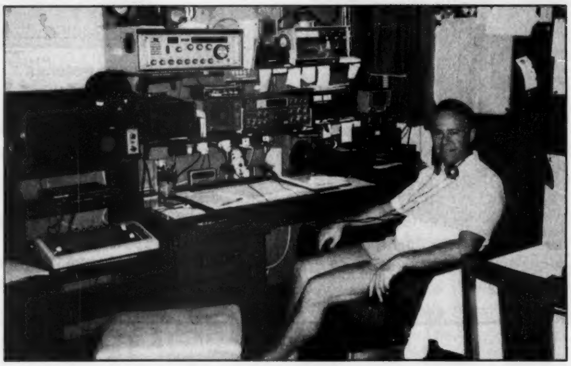
Of course, we'd already set aside the space for a couple of introductory paragraphs telling you how wonderful this fellow is, and what a Big Gun he is—you know, the standard bio. Now you'll have to wait until next month. If you think you're a real DX hotshot and can figure out the identity of our mystery columnist, drop a line to 73 Magazine, WGE Center, Peterborough NH 03458, Attention: DX Hotshots. We'll try to think of a suitable prize.—Eds.

On the Bands

If you hear a familiar voice signing BV, HL, or VS6 early in October, it may very well be our own W2NSD—he'll be heading east for a tour of Asia. **Chatham Island:** ZL7BKM is regularly near 14.015 or 14.210 MHz from 0200 UTC and again from 1300 UTC. **Pagalu Island** (formerly Annobon): The TR group that did such a great job as 3C0A in June and July is hoping to return there this month to satisfy the allband, all-modes requirements of those who missed their last outing. **Guyana:** 8R1Z operated by NQ4I slated for October 20–30. Rick is there for the *CQ* WW SSB contest on the 25th and 26th and will be on before and after the test on both CW and SSB, all bands but with emphasis on 75/80 and 160 meters. Europeans can look for Rick near 1827 QSX 1849 kHz during the first 10 minutes of every hour from 0200–0700 UTC. **Trinidad Island:** In honor of the 9th IARU Region 2 conference being held in Buenos Aires this month, members of Argentina's Radio Club del

QSL ROUTES

Call	Via	Call	Via
A71AD	5B4TI	V30AA	N6ADI
C30C	F8RV	V30DX	N6ADI
C30CYA	PA3BMJ	V44KG	WB2LCH
C30LDM	DL4BBO	VE8MA	VE5FZ
C56/EA5AL	EA5EBX	VK4KA	KA5RGE
CQ0AHU	CT1AHU	VK9ZG	VK6YL
CR9XX	VS6DX	K1CLN/VP2M	K1CLN
CS0AT	W1JZ	W2JGR/VP2M	W2BIE
CT3/W2ZZ	W2ZZ	K2MFY/VP2M	K2MFY
CT4AT	W1JZ	K2OVS/VP2M	K2OVS
D68WS	DJ6QT	KD2SX/VP2M	WB2RNT
DP0GVN	DL2NF	VP2MU	W2BIE
EA8/OH8NW	OH8NW	VP5DG	KA5DGE
ED5PAD	EA5BQS	VP5Y	N6EK
EJ8CC	EI8CC	VP5Z	KC2RS
EK1AO	UZ1OWA	VQ9RN	G3WAO
EL7/EL8E	GM4LDU	VQ9ZZ	N4GNR
EO2QGL	UQ1GWF	VR6AT	G4RUL
ER3A	UZ3AZO	VR6YL	W6HS
EU3P	UP1BWW	K5KG/VS6	K5TU
FM4DS	F6FMU	K9EL/VS6	K9EL
FM5DS	F6FMU	WP4G	KP4FH
FO8AS	N5DD	XT2BR	F6FNU
FO0WR	N6VO	XT2BS	F6FNU
FS/K2IBW	K2IBW	XX9CW	DK7PE
H44BL	SM6APQ	XX9WS	JA1WSD
HA5KDB	HA7SU	YJ0ABS	DL2GAC
HA5KDQ	HA7SU	YT3W	YU3FOP
HA5KDX	HA7SU	YT4I	YU4EBL
HB0/DA1WA	DJ0LC	YW1J	YV1EJU
HC1BW	KT1N	YZ7AA	YU7MAY
HG5A	HA7SU	Z21EV	W3HNK
HG8UOT	HA5KDB	ZC4EE	IK8DYD
HG40A	HA7SU	ZF1MM	VE5RA
HL9IE	F6FNU	ZF2AH	WA6VNR
HL9OB	N4GNR	ZF2CD	W3ODJ
HU1DX	WA0JYJ	ZK1XE	WB6GFJ
HV1CN	I0CPY	ZK1XM	KB1CM
IO9AF	IT9AF	ZK1XV	VK2BCH
J3ABP	K5TU	ZL7BKM	ZL2HE
JA1YWX/JD1	JA1YWX	ZS25TUK	ZS6BCR
JR2FOE/JD1	JA4FWM	ZV2BW	PT2ADV
JW8FG	LA8FG	ZV2KT	PT2ADV
JY9RL	WA6POZ	ZV5KT	PY2KT
AI6V/KH6	AI6V	3C0A	TR0A
KB1CM/KH8	KB1CM	3D2DD	N5RM
KB1HM/KJ6	KB1HM	3X4/LA2EX	N4CID
KR7Q/KX6	KR7Q	4A1HC/4A2	AA5B
OA1A/KP2	K5TVC	4M5J	YV3EJA
K5KG/OH0	K5TU	4N1ARU	YU4FRS
K5KG/OJ0	K5TU	4N2AA	YU2ADE
OH0MD/OJ0	OH2BH	4N3KV	YU3JS
OY1R	W2KF	4V2C	WI4K
OY5NS	W3HNK	4W1NN	OE9SLH
P43SF	PJ3SF	4X8T	N4GNR
PA6VHS	PA0DIN	5B4/SM6JZ	SK6EI
HB9TL/PJ4	HB9TL	5H3ZR	SM3LDB
PP8ZAT	KC8YN	5J1LHI	HK1AMW
PY0FE	PY1BVY	5J1LR	HK1QQ
PZ5JR/P27	K3BYV	5N8BAV	I2ZGC
ST2SA	DJ9ZB	5R8AL	WA4VDE
TI1A	TI2CCO	5W1FR	KB1CM
TJ1CH	F6FNU	6W6NJ	N5GAP
TK4HC	F6FNU	7J1ACH	NG7X
TK5EL	F6FNU	8P9AK	AK6T
TL8HZ	PA0ZBL	8R1Z	NQ4I
TP2CE	F6EYS	9H3DX	DF2UU
TU2JT	F6CXV	9Q5CT	AK1E
TV3BZ	F6CRT	9X5VA	W2PPG
UF7FWW	UF6FFF	9Y4E	WA4WTG
UP9A	UP1BZZ	9Y4F	W3HNK
V3DX	N6ADI	9Y4VE	VE3CGO



Here's Phil Weaver VS6CT relaxing a bit after a vacation to the states and a mini DXpedition to KH2.

100% QSL RETURNS

Here are a few tips that are the result of my checking into the gripes of many so-called DXers who, after complaining bitterly about their failure to get QSL responses, were found to have improperly executed their cards or had failed to provide return postage.

The Card

Your QSL card should have all of the QSO information and *your* callsign on the same side. If they are not printed that way, write your call conspicuously on the side with all of the information.

It is essential that you double-check your log when entering the date, time (in UTC!), band, and so on. Many "not in the log" replies are the result of errors on the card and the use of local time rather than UTC.

The Procedure

Unless you are QSLing via a bureau, *always* furnish an SASE or an SAE with either IRCs or a dollar bill ("green stamp") to cover return postage. Check the *Callbook* for a list of the number of IRCs required for each country.

The majority of QSL cards are 3-1/2" x 5-1/2" and fit nicely into a 4" x 6" envelope. However, many foreign cards are larger, so you should send a 5" x 7" SAE when QSLing an overseas station. Prepare your mailing like this: Fold the SAE in half and insert it, fold down, in your envelope. If you are including a dollar bill, wrap it in a sheet of carbon paper, fold it in half, and place it in the fold of your SAE (not in it). Tuck IRCs and your QSL card into the fold of the SAE, seal it up, and start filling out your DXCC application.

WAP
YB3 CEV
WP

Yan Bambang YB3CEV at the operating position of his station in Surabaya in Indonesia.

Five of the ops at BY1QH, all of them engineering students at Quing Hau University. Left to right: Chang, Station Master Yuan, Liou, Ou, and Wang. The caps were donated by the W7PHO Family Hour net.

Plata will activate for the first time Trinidad Island from October 20–25. The island is in the Atlantic, 31 miles south of Bahia Blanca. The club has filed a request that Trinidad be added to the IOTA Award list and that their DXpedition be considered the official start date for IOTA accreditation. Look for AZ1D on (CW) 3.510, 7.005, 14.020, 21.020, 28.020; (SSB) 3.690, 7.090, 14.200, 21.300, and 28.600. On VHF, the frequencies will be 50.110, 146.52, and 144.300 MHz. QSLs go to LU2DT.

OH1RY will be on a South Sea Island DXpedition this month: Look for him signing /3D2 on Fiji October 19–22, /T2 on Tuvalu October 22–29 (during the *CQ* WW SSB test), /A35 from Tonga between October 29 and November 5, and /5W1 on Western Samoa from the 5th to the 9th of November. QSL to his home address.

The Bulgarian Federation of Radio Amateurs is celebrating the 60th anniversary of the founding of the first Bulgarian radio club with a special award. To qualify, earn 60 points during July 15th to December 31st, 1986, by contacting LZ6 stations (6 points each) or other LZ stations (1 point each). The award is free; send your logs to BFRA, PO Box 830, 1000 Sofia, Bulgaria.

Our French correspondents are expressing optimism in the assignment of at least one amateur in each of the crews that are now being readied for immediate departure to Crozet and also next month's voyages to Kerguelen and Amsterdam Island. Jim and Kirsti Smith (VK9NS and VK9NL) are assessing new (and apparently less rigorous!) opportunities for another DXpedition to Heard Island in early 1987.■

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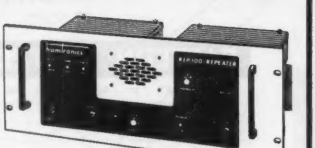

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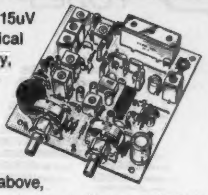

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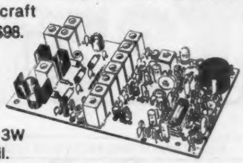

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VHF MODELS		220-222	28-30
Kit with Case	**$49**	220-224	144-148
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Model XV2	28-29	145-146
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Wired $149	27-27.4	144-144.4
(Specify band)	28-30	220-222*
	50-54	220-224
	144-146	50-52
	144-146	28-30
For UHF,	28-30	432-434
Model XV4	28-30	435-437
Kit $79	61.25	439.25
Wired $139	144-148	432-436*

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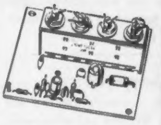

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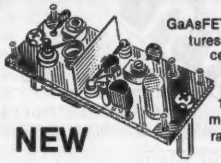
MODEL	TUNING RANGE	PRICE
HRA-144	143-150 MHz	$49
HRA-(*)	150-174 MHz	$49
HRA-220	213-233 MHz	$49
HRA-432	420-450 MHz	$64
HRA-(*)	450-470 MHz	$64

**Specify Center frequency desired*

MINIATURE PREAMPS



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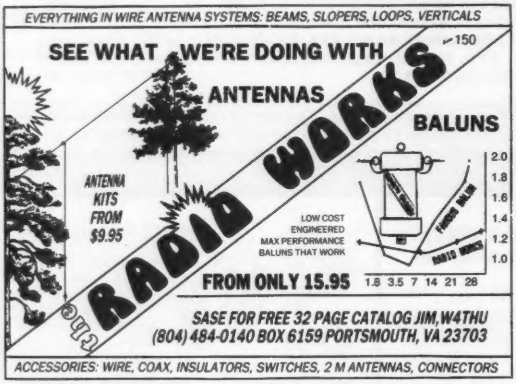
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Serving the ham community with new and used equipment. We stock and service most major lines: AEA, Astron, B&W, Cushcraft, Encomm, Hy-Gain, Hustler, ICOM, Kenwood, KLM, Larsen, Mirage, Mosley; books, rotors, cable and connectors. Business hours Mon.–Sat. 10–5, Thursday 10–9. Closed Sun./Holidays. **Rivendell Electronics, 8 Londonderry Road, Derry, NH 03038, 434-5371.**

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Your company name and message can contain up to 25 words for as little as $150 yearly (prepaid), or $15 per month (prepaid quarterly). No mention of mail-order business or area code permitted. Directory text and payment must reach us 60 days in advance of publication. For example, advertising for the December '86 issue must be in our hands by October 1st. Mail to *73 Amateur Radio*, WGE Center, Peterborough, NH 03458. ATTN: Hope Currier.

PROPAGATION

Number 23 on your Feedback card

Jim Gray W1XU
73 Staff

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA							20	20				
ARGENTINA								15	15	15	15	15
AUSTRALIA						40	20	20			15	15
CANAL ZONE	20	40	40	40	40		20	15	15	15	15	20
ENGLAND	40	40	40				20	20	20	20		
HAWAII		20			40	40	20	20				15
INDIA							20	20				
JAPAN							20	20				
MEXICO		40	40	40	40		20	15	15	15	15	
PHILIPPINES							20	20				
PUERTO RICO		40	40	40	40		20	15	15	15	15	
SOUTH AFRICA									15	15	15	
U. S. S. R.							20	20				
WEST COAST			80	80	40	40	40	20	20	20		

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	20	20						15				
ARGENTINA										15	15	15
AUSTRALIA	15	20				40	20	20				15
CANAL ZONE	20	20	40	40	40	40			15	15	15	20
ENGLAND		40	40					20	20	20	20	
HAWAII	15	20	20	20	40	40	40					15
INDIA								20	20			
JAPAN								20	20			
MEXICO	20	20	40	40	40	40			15	15	15	20
PHILIPPINES								20	20			
PUERTO RICO	20	20	40	40	40	40			15	15	15	20
SOUTH AFRICA										15	15	20
U. S. S. R.								20	20			

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	20	20	20		40	40	40	40				15
ARGENTINA	15	20		40	40	40					15	15
AUSTRALIA		15	20	20			40	40				
CANAL ZONE			20	20	20	20	20	20				15
ENGLAND									20	20		
HAWAII	15	20	20	40	40	40	40					15
INDIA		20	20									
JAPAN	20	20	20			40	40	40			20	20
MEXICO			20	20	20	20	20					15
PHILIPPINES	15						40		20			
PUERTO RICO			20	20	20	20	20	20				15
SOUTH AFRICA										15	15	
U. S. S. R.									20			
EAST COAST		80	80	40	40	40	40	20	20	20		

The first part of the month will be more unsettled than the last part. Expect an unsettled geomagnetic field through the 5th and again around the 15th. The 20th–21st could also have an active field. Barring development of a coronal hole, you can expect good fall DX propagation, particularly around contest time.

OCTOBER

SUN	MON	TUE	WED	THU	FRI	SAT
			1 F–P	2 F–P	3 P	4 F
5 F	6 F	7 F	8 F–G	9 G	10 G	11 G
12 G	13 G–F	14 F	15 F–G	16 G	17 G	18 G–F
19 F–P	20 P	21 P–F	22 F–G	23 G	24 G	25 G
26 G	27 G	28 G	29 G	30 G	31 G	

We're Building the West's Largest Convention of Amateur Radio Operators

November 7–8

All day Friday and Saturday

Las Vegas, Nevada

EXCUSE OUR DUST! We're busy building the largest annual convention of amateur radio operators in the West and we're not stopping to rest along the way. Last year we called it "OCTOBERVENTION" and it was incredible! Now it's HAM/WEST and it's going to be even bigger and better! We have only one goal — to be the biggest ham convention in the West! We've got it all — prizes, technical talks, exhibitors with those new products for Christmas, giant flea market, free VEC exams, free cocktail party, awards banquet and ladies' programs, not to mention all the fun, excitement and glamour of Las Vegas and the beautiful Western scenery and climate!

ALL WE NEED TO COMPLETE OUR CONSTRUCTION PROJECT IS YOU! How do you become a part of this exciting new chapter in amateur radio history? Just send us this form, call your travel agent or fire up your mobile rig, and plan to BE THERE!

GENERAL INFO: Plan to travel on Thursday. Exhibits and forums will be open 8 a.m.-5 p.m. Friday and 8 a.m.-4 p.m. Saturday. Awards banquet will be at 8 p.m. Saturday.

REGISTRATION INFO: Every person taking part in the HAM/WEST activities must be registered. Advance registration is $12 before October 24 ($15 at the door) and includes prize tickets and admission to all HAM/WEST activities except the banquet. It is not necessary to be registered to purchase tickets for the Saturday evening awards banquet. Flea-market sellers must be registered; outdoor spaces measure 16'x20' (two parking spaces). Born in 1966 or later? Request complimentary "admission-only" tickets (no prizes) at the door. And — there's no fee for VEC exams taken at the convention!

HOTEL INFO: To guarantee your room, you must **make your room reservations directly with HAM/WEST**, either on this form or by phone (if charging to a credit card), and **make payment in full before October 1, 1986**. Reservations not paid by that time will be accommodated on a *space-available basis only*. Call HAM/WEST at 702-361-3331.

RV INFO: Call Camperland directly at 800-634-6942 to reserve a space with full hookups right on the hotel grounds. Be sure to mention HAM/WEST. Call now. These spaces fill up early!

( ) **I WANT TO REGISTER FOR HAM/WEST '86:**

Name ______________________________ Call letters ____________

Address ______________________________

City ____________________ State ________ ZIP ____________

( ) **I WANT TO TAKE A VEC EXAM, CLASS ____________.**

(Please enclose a self-addressed, stamped envelope marked "VEC Exam" with this application if you are planning to take an exam.)

( ) **PLEASE RESERVE A ROOM FOR ME AT THE HACIENDA HOTEL:**

Register room to ______________________________

Last name First name M.I.

Arrival day/date ____________________ Arrival time ____________

Departure day/date ____________________ Number of nights ____________

How many persons will stay in this room? ( ) One ($55.00/night) ( ) Two ($55.00/night) ( ) Three ($65.00/night) ( ) Four ($75.00/night)

How many beds do you need? ( ) One double bed ( ) Two double beds ( ) One king-size bed

Any special requests? ______________________________

Amount for room $__________ ( ) **Check or money order enclosed**

Plus 7% room tax $__________ ( ) **Charge to credit card #** ____________ Exp. date ________

Advance reg., $12/person $__________ Print your name ____________ Phone ____/________

Banquet, $20/person $__________ ( ) M/C ( ) VISA

Flea market, $20/space $__________ ( ) AMEX Authorized Signature ____________

Total amount $__________ Note: We will bill your credit card account in full when your registration form is received.

HAM/WEST, P.O. Box 19675, Las Vegas, NV 89132, 702-361-3331

Or This Inexpensive

It Really Shouldn't Be This Easy

Remember just a few years ago, how it took a roomful of equipment just to work RTTY. And if you wanted more than one mode it took a dedicated computer system costing thousands of dollars. The new AEA Pakratts are proving it doesn't take lots of equipment or money to enjoy working all bands in five different modes.

First, A Good Idea

The idea behind the Pakratt is very simple. One controller that does Morse, Baudot, ASCII, AMTOR, and Packet, and works both HF and VHF bands. Of course the decoding, protocol, and signal processing software must be included in the unit, and connection to the computer and transceiver have to be easy. The unit also has to be small and require only 12 volts, so it will work both in the shack and on the road.

Second, Computer Compatible

It doesn't matter what kind of computer you have, we have a Pakratt for you. The PK-64 works with the popular Commodore 64 or 128, and the PK-232 works with any other computer or terminal that has an RS-232 serial port. The PK-64 doesn't require any additional programs. Simply connect to the computer and transceiver and you're on the air. The PK-232 needs a terminal or modem program for your computer. The one you're using with your telephone modem will work just fine.

PAKRATT™ Model PK-64

PAKRATT™ Model PK-232

Third, Performance and Features

The real measure of any data controller is what kind of on-air performance it gives. While the PK-64 and PK-232 use different types of modems, both give excellent performance on VHF. The optional HF modem of the PK-64 uses independent four-pole Chebyshev filters for both Mark and Space tones, and A.M. detection. The HF option can be factory or field installed.

The PK-232 uses an eight-pole bandpass filter followed by a limiter discriminator with automatic threshold correction. The internal modem automatically selects the filter parameters, CW Fc = 800 Hz, BW = 200 Hz; HF Fc = 2210 Hz, BW = 450 Hz; VHF Fc = 1700 Hz, BW = 2600 Hz.

The PK-64 uses on screen indicators to show status, mode, and DCD (Data Carrier Detect) while the PK-232 uses front panel indicators. Both units use discriminator style tuning for HF operation. And that's just the tip of the iceberg. Features like multiple connects on packet, hardware HDLC, CW speed tracking, and other standard AEA software features are included in both the PK-64 and PK-232.

Fourth, AEA Quality and Price

Not many manufacturers like to discuss quality and price at the same time. AEA thinks you want high quality and low price in any product you buy, so that's what you get with the Pakratts. Ask any friend who owns AEA gear about our quality. The people who buy our products are our best salespeople. As for price, the PK-64 costs $219.95, or $319.95 with the HF option. The PK-64A, an enhanced software unit with a longer flexible computer cable, costs $269.95 or $369.95 with the HF option. The PK-232 costs $319.95 with the HF modem included. All prices are Amateur Net and available from your favorite amateur radio dealer. For more information contact your local dealer or AEA.

Prices and specifications subject to change without notice or obligation.

✓65

AEA

Advanced Electronic Applications, Inc.
P.O. Box C-2160, Lynnwood, WA 98036-0918
206-775-7373 Telex 6972496 AEA INTL UW

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2m
FT-290RII
ALL MODE TRANSCEIVER
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MR
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CALL
RPT
STEP
REV
MODE
M
MIC
YAESU
6m
FT-690RII

Introducing all-mode radios for your mode of travel.

Yaesu's 2-meter FT-290R and 6-meter FT-690R Mark II Series are the perfect all-mode traveling companions.

On the road, simply snap on the heat sink, apply 12 volts of power, and you've got a 25-watt mobile station. (FT-690R: 10 watts).

On foot, attach the optional C-cell battery pack and shoulder strap, and take off with 2.5 watts RF output.

You get around fast on SSB, CW and FM with ten memories, dual VFOs, LCD display, automatic storage of repeater shift into memory register, offset tuning during receive or transmit for satellite operation, relative power output/S-meter, and optional CTCSS unit.

And everything fits into a lightweight-yet-rugged case, measuring just 2¼ x 6½ x 8¼ inches.

The FT-290R and FT-690R Mark II are perfect for emergency use, camping trips, talking around town, and DX work.

Plus each is priced to maximize your ham budget's mileage.

So discover Yaesu's 2-meter FT-290R Mark II and 6-meter FT-690R Mark II all-mode transceivers today. They're just a quick trip away at your nearest Yaesu dealer.

YAESU

Our 30th Anniversary.

Yaesu USA 17210 Edwards Road, Cerritos, CA 90701 (213) 404-2700
Customer Service: (213) 404-4884 **Parts:** (213) 404-4847
Yaesu Cincinnati Service Center 9070 Gold Park Drive, Hamilton, OH 45011 (513) 874-3100

Prices and specifications subject to change without notice.

KENWOOD

...pacesetter in Amateur radio

NOW BUILT-IN CTCSS!

By Popular Demand!

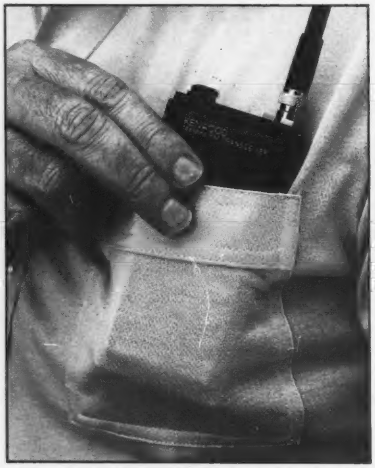
TH-21BT/31BT/41BT

The smallest HT™ is now even better! The new "BT-Series" gives you a plus—a built-in DIP switch programmable CTCSS encoder! Now you can access more than one "private line" over the air! The original TH-21A Series (The Smallest HT™) is still available from the VHF leader—Kenwood!

- **High or low power.** Choose 1 watt high—enough to "hit" most local repeaters; or a battery-saving 150 mW low.
- **Pocket portability!** Kenwood's TH-series HTs pack convenient, reliable performance in a package so small, it slips into your shirt pocket! It measures only 57 (2.24) W x 120 (4.72) H x 28 (1.1) D mm (inch) and weighs 260 g (.57 lb) **with PB-21.**
- **Expanded frequency coverage (TH-21BT/B).** Covers 141.000-150.995 MHz in 5 kHz steps, includes certain MARS and CAP frequencies.
  TH-31BT/B: 220.000-224.995 MHz in 5-kHz steps.
  TH-41BT/B: 440.000-449.995 MHz in 5-kHz steps.

DIP switch programmable CTCSS encoder built-in!

KENWOOD
144MHz FM TRANSCEIVER
1
2
3
A
4
5
6
B
7
8
9
C
0
D
TH-21BT



- **Easy-to-operate, functional design.** Three digit thumbwheel frequency selection and top-mounted controls increase operating ease.
- **Repeater offset switch.**
  TH-21BT/B: ±600 kHz, simplex.
  TH-31BT/B: −1.6 MHz, reverse simplex.
  TH-41BT/B: ±5 MHz, simplex.
- **Standard accessories:** Rubber flex antenna, earphone, wall charger, 180 mAH NiCd battery pack, wrist strap.
- **Quick change, locking battery case.** The rechargeable battery case snaps securely into place. Optional battery cases and adapters are available.
- **Rugged, high impact molded case.** The high impact case is scuff resistant, to retain its attractive styling, even with hard use.

Optional accessories:

- **HMC-1** headset with VOX
- **SMC-30** speaker microphone
- **PB-21** NiCd 180 mAH battery
- **PB-21H** NiCd 500 mAH battery
- **BC-2** wall charger for PB-21H
- **BC-6** 2-pack quick charger
- **DC-21** DC-DC converter for mobile use
- **BT-2** manganese/alkaline battery case
- **EB-2** external C manganese/alkaline battery case
- **SC-8/8T** soft cases with belt hook
- **BH-3** belt hook
- **AJ-3** thread-loc to BNC female adapter
- **RA-8A/9A/10A** StubbyDuk antenna
- **TU-6** sub-tone unit (TH-21AT/A only)

More information on the Smallest HT™ is available from Authorized Kenwood Dealers.

TH-series transceivers shown with optional StubbyDuk antenna.
Specifications and prices are subject to change without notice or obligation.
Complete service manuals are available for all Trio-Kenwood transceivers and most accessories.

KENWOOD

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